The role of technology licensing in the diversification strategies of small firms.

Crawford, Nicholas K.

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THE ROLE OF TECHNOLOGY LICENSING IN THE DIVERSIFICATION STRATEGIES OF SMALL FIRMS

Submitted by Nicholas K Crawford
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Nick Crawford

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The study was carried out whilst I was working on an empirical investigation into Technology Licensing in small and medium sized firms in the UK. This study was supervised by Julian Lowe and funded by the Leverhulme Trust. Various cases referred to in the text have been taken from this study, although they have been further developed to fit with the strategic management framework of this thesis. New cases have been researched to provide evidence for the hypothesis later developed and tested. The original Leverhulme empirical study has been published in various articles and books and forms a background for much of the work reported on in this thesis. I would therefore wish to record my thanks to the Trust for supporting this work.

Executives of the forty case study companies provided liberal assistance and co-operation and were unstinting with their time. Many other organisations also provided substantial help. Particular mention should be made of the Licensing Executives' Society which provided many useful contacts.

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SUMMARY

The primary objective of this work has been in testing the global hypothesis that technology licensing (the purchase and sale of technology as an alternative to that of goods), is used as a tool in the diversification strategies of small manufacturing firms. The research suggests that diversification does commonly occur in such firms and that technology licensing can be a factor in this.

Diversification emerged as important at the median of the small firm scale (100-200 employees). Such firms were found to diversify substantially more than either very small or medium sized firms, although very large firms also exhibited a high degree of diversification.

Technology licensing was shown to be used by a minority of small firms. Of those which had utilised inward licensing to obtain new products or processes, a majority had done so reactively, usually to overcome product line deficiencies. Where outward licensing or both inward and outward licensing had been utilised, it had generally been used more proactively, frequently as part of a longer term strategy of product and market diversification and as a means of conserving scarce resources for more profitable use elsewhere.

It is considered that the empirical evidence supports the views of previous workers, that smaller manufacturing firms can be divided into sub-sets of proactive and reactive groups and that the hypothesis upon which the study was based was mainly substantiated in the case of companies which had used outward licensing or both inward and outward licensing. In the case of inward licensing companies it is considered that the hypothesis is incompletely substantiated, in that a large majority of inward licensing appeared to be wholly reactive and could only be encompassed within a 'strategy' of survival.

CONTENTS

Page No

Acknowledgements ii

Summary iii

Contents iv

PART I

CHAPTER 1 INTRODUCTION 1

A Technology Licensing 2
B Objectives of the Thesis 3
C Hypothesis Considered 5
D Thesis Structure 5
E Use of the Thesis 9

CHAPTER 2 - SMALL FIRMS AND THE FORMULATION OF BUSINESS POLICY 10

A Introduction 11
B Characteristics of Small Firms 16
1. Definitions 16
2. Small Firms in British Manufacturing Industry 17
3. Ownership and Legal Status 18
4. The Financial Characteristics of Small Firms 19
C The Formulation of Business Policy 21
1. Introduction 21
2. Factors Impinging Upon Policy Decisions 22
3. Policy Making Structures and Firm Size 25
4. Development of New Product Policies by Small Firms 30
5. Product Life Cycles and the Implementation of Business Policy 37
D Other Small Company Policy Issues 48
1. Introduction 48
2. Role of the 'Corporate Plan' 49
3. Factors Pertaining to Flexible Response 50
4. Reactive and Proactive Factors - Market Control 53
5. Comparative and Absolute Advantage 54
6. Licensing in the Development of New Product Strategies 57
7. Conclusion 58
E A Measure of Small Firm Flexibility 60
1. Introduction 60
2. Method 61
3. Results, Interpretation 65
4. Industry Case Studies 73
F Conclusions 81

		Page No
Appendices to Chapter 2		83
Appendix 2.1	Expenditure on Capital, Research and Development and Stocks/Work in Progress as a Percentage of Output Attributable to Small Firms	84
Appendix 2.2a	Regression Analysis Output: Capital Expenditure	85
Appendix 2.2b	Regression Analysis Output: R & D Expenditure	86
Appendix 2.2c	Regression Analysis Output: Stocks and Work in Progress	87
Appendix 2.2d	Regression Analysis Output: Capital Expenditure, R & D, Stocks and Work in Progress	88
Appendix 2.3a	Industry Data - Capital Expenditure	89
Appendix 2.3b	Industry Data - Stocks/Work in Progress	90
Appendix 2.3c	Industry Data - Employment	91
Appendix 2.3d	Industry Data - Net Output	92
Appendix 2.4a	Company Size:Capital Expenditure: Stocks and Work in Progress, Employment, Net Output as follows:	
Appendix 2.4a	Leather Goods	93
Appendix 2.4b	Timber and Furniture	94
Appendix 2.4c	Metal Goods	95
Appendix 2.4d	Clothing and Footwear	96
Appendix 2.4e	Bricks/Pottery/Glass	97
Appendix 2.4f	Paper/Printing/Publishing	98
Appendix 2.4g	Instrument Engineering	99
Appendix 2.4h	Mechanical Engineering	100
Appendix 2.4j	Textiles	101
Appendix 2.4k	Food/Drink/Tobacco	102
Appendix 2.4l	Chemicals/Allied	103
Appendix 2.4m	Metal Manufacture	104
Appendix 2.4n	Shipbuilding	105
Appendix 2.4o	Electrical Engineering	106
Appendix 2.4p	Coal and Petroleum	107
Appendix 2.4r	Vehicles	108

CHAPTER 3 - DIVERSIFICATION AND THE SMALL FIRM 109

A Introduction 110
B Strategic Diversification - A Theoretical Framework 111
1. Definitions 111
2. Diversification Pressures 114
3. Types of Diversification 117
4. Review of Definition of Diversification Types 122
5. Potential Advantages of Diversification Strategies 123
C A Review of the Empirical Evidence on Diversification 126
1. Introduction 126
2. Reasons for Diversification 129

Page No

3. Measuring Diversification 131
4. The Extent of Diversification 136
5. Large Company Diversification 139
6. Small Firm Diversification 141
7. Factors Explaining Diversification 142

D A Study of Small Firm Diversification 144
1. Background 144
2. The Small Firm Study 147
3. Method - Data Collection 148
4. Data Presentation 150
5. Data Analysis and Results 151
6. Postulations Based on the Results 166

E Conclusions 171

Appendices to Chapter 3 173

Appendix 3.1 Small Firm Sample - Company Size: Number of Firms 174
Appendix 3.2 Small Firm Sample - Company Size: Numbers of Product Groups I 175
Appendix 3.3 Small Firm Sample - Company Size: Numbers of Product Groups II 176
Appendix 3.4 Small Firm Sample - Company Size: Numbers of Firms in 1 and 4+ Product Groups 177
Appendix 3.5 Small Firm Sample - Company Size: Moving Average of Percentages in Product Groups 178

CHAPTER 4 - TECHNOLOGICAL CHANGE, INNOVATION AND NEW PRODUCT DEVELOPMENT IN SMALL FIRMS 179

A Introduction 180

B Technology Sources and Resources 183
1. The Technology Life Cycle 183
2. Sources and Development of Technology 186
3. Diffusion of Technology 193

C The Management of Technology in Small Firms 199
1. The Technological Environment of the Small Firm 199
2. The Process of Technology Management in Small Firms 201
3. The New Product Development Process in Small Firms 205

D Risk, Growth and New Product Development 210
1. Measurement of Risk 211
2. Growth Characteristics of Small Firms 213

E Conclusion 218

Appendix to Chapter 4 220

Page No

PART II

CHAPTER 5 - TECHNOLOGY LICENSING - SCOPE,SCALE AND RATIONALE 223

A Introduction 224
B Literature Review 228
C Alternative Strategies in Technology Sale 232
1. Patent Sale 233
2. Divestment of Companies or Divisions 234
3. Contractual Sale 235
D The Strategic and Economic Rationale for Outward Licensing 236
1. Profit and Associated Factors 237
2. Political Factors 239
3. Geographical Factors 240
4. Anti-competitive Factors 242
5. Tax Related Factors 246
6. Sociological and Policy Factors 248
7. Resource Factors 249
8. Transfer Cost Factors 251
9. Product Specific Factors 252
10. Other Strategic Factors 252
E Alternative Strategies for Technology Purchase 254
1. Product Purchase 255
2. Company Acquisition 255
3. Key Personnel Acquisition 256
F The Strategic and Economic Rationale for Inward Licensing 258
1. Development Cost Factors 259
2. Speed Factors 261
3. Technology Push 263
4. Diversification 264
5. Other Strategic Factors 265
G The Scope of Technology Licensing 266
1. United Kingdom and International Trade in Technology 267
2. Licensing Returns 270
H Large and Small Firm Licensing 273
1. Policy Factors 274
2. Information Provision and Resource Availability 275
I Conclusion 276

CHAPTER 6 - TECHNOLOGY LICENSING AND STRATEGIC PRODUCT PLANNING IN SMALL MANUFACTURING COMPANIES 279

A Introduction 280
B Technology Licensing and Small Firms 281
(Some Evolving Hypotheses)
1. Internal Considerations 284
2. External Considerations 295

Page No

C. Modelling the Licensing Process in Small Firms	304
1. Licensing Trigger Signals	304
2. The Operation of Licensing Markets	307
3. Licensing in Small Firms - A Decision Model	309
D. Strategic Licensing Process in Small Firms (Empirical Evidence)	313
1. Introduction	313
2. Research Evidence	314
3. Data Presentation and Analysis	319
4. Testing of Hypotheses	340
E. Conclusions/Discussions	368
Appendices to Chapter 6	371
Appendix 6.1 Inward Licensing Cases	372
Appendix 6.2 Outward Licensing Cases	415
Appendix 6.3 Inward/Outward Licensing Cases	457
Appendix 6.4 'Random' Licensing Cases	503
Appendix 6.5 Summary Case Analysis	553
Appendix 6.6 Swedish Case Studies	594
CHAPTER 7 - CONCLUSIONS	597
A. Introduction	598
B. Review of Technology Licensing in a Business Policy Context	599
C. Conclusions of Adopting a Case Approach	603
D. Technology Licensing and Business Strategy in the Small Firm - Conclusions	606
1. The use of Technology Licensing as an Alternative Strategy	606
2. When Technology Licensing is Used	609
3. How Technology Licensing is Used	613
4. The Success of Technology Licensing as a Business Strategy	615
E. The Practical Use of Technology Licensing	618
1. Inward Technology Licensing	618
2. Outward Technology Licensing	621
F. Possible Further Work	623
G. Final Thoughts	627
Bibliography I	629
Bibliography II	639

PART I

CHAPTER 1

INTRODUCTION

A. TECHNOLOGY LICENSING

Recent Government policies on the stimulation of business activity have concentrated on the development of new industries to replace the old, new enterprises to replace recession hit firms and an emphasis on the role that smaller firms may be able to play in developing new employment opportunities. Industrial policy has also concentrated on the development of new technologies to replace outmoded or obsolescent techniques.

However, while Government proposes the formation of new enterprises and the development of new technologies and products, there is less empirical evidence on the success of methods designed to promote such regeneration. It is the purpose of this thesis to explore one small facet of the innovation 'spectrum', namely the diversification and new product strategies of smaller firms with particular reference to the use of inward and outward technology licensing agreements.(1) While such purchase and sale of technology is probably accepted practice within larger organisations, the processes of which have been explored by several authors, its role in the new product and market development strategies of smaller firms appears to have received more scant attention. It is therefore to this sector that the thesis is devoted.

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1. Throughout this thesis, a 'licence' is defined as the purchase under contract (by a licensee), of the rights to use the intellectual property of another individual or organisation (the licensor). A fuller definition of 'licensing' is made in Chapter Five.

B. OBJECTIVES OF THE THESIS

The thesis reports upon an examination of the new product and market development processes in smaller firms where licensing agreements have been an integral part of such developments. A core technique was the use of 'in-depth' case studies to define company objectives. Specifically, the following objectives were set:

1 To explore the policy making processes in smaller firms to identify key variables within the new product development process.

2 To measure the role and scale of diversification within smaller manufacturing firms to determine whether such firms do carry out diversification strategies.

3 To identify the scope of technology licensing in the product and market strategies of smaller firms.

4 To consider whether technology licensing is a suitable method for market realisation by such firms.

It was not an objective to consider only what might be considered 'high technology' companies. While such firms clearly are an important sub-sector, they may not always be typical of companies in the small firm sector as a whole. Rather, it was an objective to consider a cross section of small manufacturing firms to define how they used licensing and whether greater use could be made of the technique in the small firm sector.

The author's interest in the use of technology licensing arose, initially, during employment in a medium sized manufacturing company in the building products industry, in 1977. It was observed that diversification into new fields of activity could be very difficult to manage, when new skills had to be learned, even where sufficient funding was available to promote the process. In this instance, 'in-house' development was utilised to develop a new and different product for a new market. However, introduction of the new product was much less successful than the potential market and product characteristics indicated were possible. This experience was not immediately translated into a recognition that technology licensing could have been relevant, but following commencement of the Master's Degree in Business Administration at Bath University, and an increasing interest in the technology policies of small firms, a deeper interest in licensing was provoked. The Leverhulme Trust provided funding for a two year research programme into the practical use of technology licensing by small firms, led by Julian Lowe. This thesis, studies for which were carried out in parallel with the 'Leverhulme' research, considers the subject of technology licensing and the small firms from a 'business policy' viewpoint however.

C. HYPOTHESES CONSIDERED

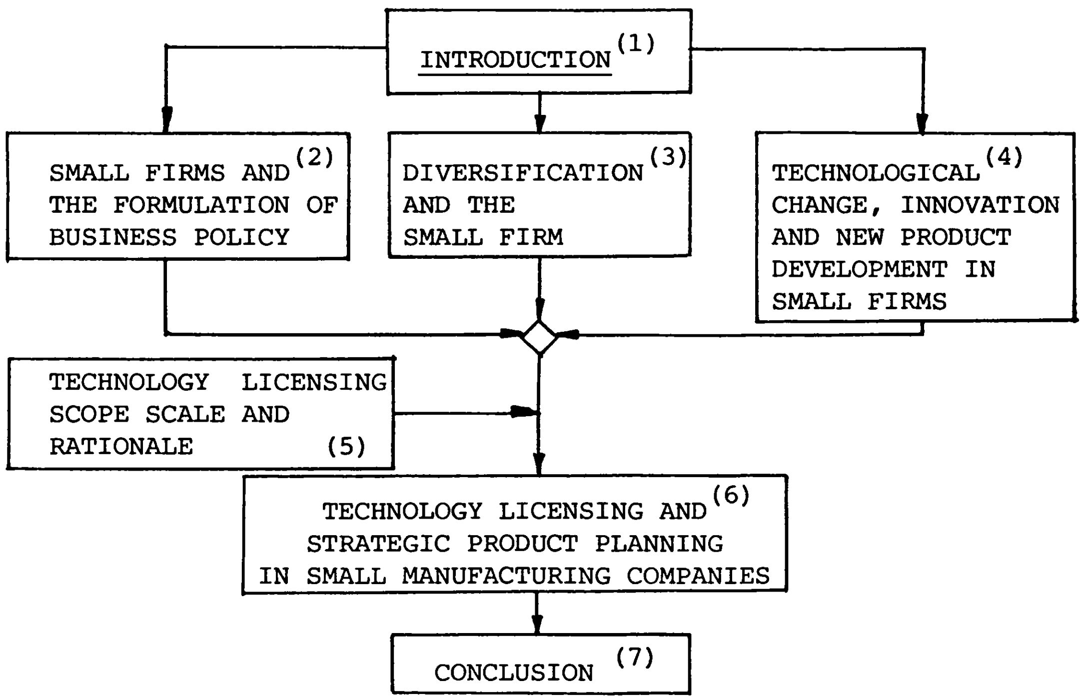
It is an objective of this study to consider the role that technology licensing plays in the diversification strategies of small and medium sized firms. The study is therefore structured to explore, first, the global hypothesis that technology licensing is used as a strategic tool in the diversification strategies of such firms. Exploration is made to define whether smaller firms do develop strategies intended to diversify their product lines; to define the effect of the technological areas in which they operate, upon those strategies and thirdly; to explore the role that technology licensing has within those strategies. Within the last area of study, comprising Chapter Six of this thesis, certain hypotheses are tested. These are explored within that chapter.

D. THESIS STRUCTURE

The thesis is divided into two major sections to facilitate exploration of the hypotheses suggested above. The first section (Chapters 2 - 4) deals with the technological environment of the firm with particular reference to the way it operates within that environment, in developing policy, and in putting strategic plans into operation through diversification into new areas of technological expertise. This section endeavours to define the particular technological characteristics of smaller manufacturing firms in relation to their ability to react to and exploit changes in the marketplace. Studies are made to define the scope and importance of diversification in smaller firms and to measure the flexibility of such firms in their new product strategies.

Part Two of the thesis, (Chapters 5 - 7), comprises an exploration of the strategic role of licensing in all companies followed by an analysis of the role that such licensing plays in the new product and diversification strategies of smaller firms. Empirical evidence is presented in Chapters Two, Three and Six to support the hypotheses generated. The structure of the thesis is as follows:-

Figure 1 - Thesis Structure



Chapters Two, Three and Four provide evidence for the thesis, running in parallel with each other. Chapter Five sets the licensing 'scene' while Chapter Six can be seen as an integrating chapter, pulling together evidence from both Part I and Part II of the thesis. The chapters are structured internally as follows:

Chapter Two considers the characteristics of small firms pertinent to the subject matter of the thesis. Empirical evidence is presented to demonstrate the product and market movements of a sample of small firms over a ten year period, to measure their flexibility in taking advantage of opportunities,and to define those industries where small firms appear to play a particularly important role.

Chapter Three explores the diversification decision process in firms and investigates why diversification may be relevant in the small firm as well as in larger firms. An empirical analysis is made of the diversification levels of a sample of smaller firms to explore the strategic implications for such firms in endeavouring to develop out of their current market segments.

Chapter Four considers the technological and innovation environment of smaller firms and investigates the impact of these upon the new product development process,with particular emphasis on the risks that smaller firms open themselves to by entering new and different markets. The main emphasis of Part I is in identifying those factors pertinent to the use of licensing *per se* by small firms.

In Part II, Chapter Five explores the strategic and economic rationale for the use of technology licensing in both large and smaller firms. Previous studies of the utilisation and extent of technology licensing are reported on, and a review of the current literature on the subject is made.

Chapter Six explores,in depth, the role of technology licensing in the context of strategic product planning in small manufacturing companies. Case studies of forty small companies are reported. Models of the licensing decision process and the operation of licensing markets are proposed. Hypotheses based upon the earlier chapters, previous work in the field, and deductions from an initial sample of technology licensing case studies are then tested. Chapter Six endeavours to integrate work in previous chapters in considering strategic licensing in smaller firms.

Chapter Seven comprises a short conclusion to the thesis with a brief review of some of the problems, advantages and results of undertaking the study in the form presented.

Background material and other relevant information not included in the thesis text has been appended to each chapter as necessary, rather than in a separate 'appendices' section at the back of the thesis. This convention was adopted for easy reference and as an alternative to the inclusion of numbers of statistical tables and diagrams within the text. The appendices comprise, therefore, an important part of each chapter and should be used in conjunction with it.

Lastly, the bibliography appended to the thesis as a whole comprises two parts. Bibliography I lists those references which provided background material for the study and have been quoted within the text. The greater number of papers that were referred to or utilised during the course of the research but are not specifically quoted in the text comprise Bibliography II. It was the author's intention that the two bibliographies should provide a comprehensive listing of recent works pertaining to technology licensing.

E. USE OF THE THESIS

It became clear during the course of investigations carried out for this thesis that there was a degree of ignorance within many small firms' management about the potential use of technology licensing. Within the population of small firms a large majority had made no use of the technique. While this made the collection of data more difficult, it also suggested a need for more sources of information on the subject. As a result of the research carried out under the Leverhulme contract, referred to above, several papers and two books on the subject of technology licensing were published jointly with Julian Lowe. The papers and books are referred to as relevant within the body of the thesis. It is hoped that the books in particular will prove to be useful to management in smaller firms considering the practical use of technology licensing, while this thesis may be of value in consideration of the role that technology licensing can play in developing longer term strategies for its use in smaller firms.

CHAPTER 2

SMALL FIRMS AND THE FORMULATION OF BUSINESS POLICY

A. INTRODUCTION

It is a major objective of this chapter to consider the small firm[1] *per se*, to highlight some of the features that may be related to the use of licensing by such firms. Several authors have suggested that the characteristics of small firms differ both in scale and scope from larger firms[2] and it is intended to explore these small firm specific factors and define the role that they might play in such firms' policy making processes, with particular reference to the use of technology licensing.

Recently, public interest in the contribution that small firms (SFs) can make to the economic activity of the industrialised countries, has grown. Over the same period, however, small firms in Britain appear to have been responsible for a shrinking percentage of gross national output. The interest in SFs has led to a situation where they are frequently cited as being of critical importance to national recovery by such influential bodies as the CBI, and the UK government.[3]

Such faith in SFs in the national economy appears to be based to a large extent on their perceived role as job creators[4] and

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1. 'Small firm' in this context relates to small manufacturing businesses (less than 200 employees) except where this is explicitly stated not to be the case. Where appropriate, evidence pertaining to small and medium sized firms is also presented.

2. Bolton J E, 'Small Firms' Report of the Committee of Inquiry on Small Firms', HMSO 1978, Cmnd 4811

3. 'A Call for Positive Discrimination', Report in *Financial Times*, 13 February 1981, on small firms

4. Ganguly, P 'Major Share of Job Creation is by Small Firms' British Business, HMSO 1984

as 'seedbed enterprises'[1] from which larger enterprises may one day grow. While there is no doubt that many SFs have developed over the years into large, successful companies, the number of such 'growth' companies in relation to the total population of SFs may be small.[2][3] The current concentration upon the role of smaller firms in the development of new economic activity may, therefore, to a certain extent, be based more upon the success of particular enterprises rather than on more broad based statistics. There is some evidence that small firms do have advantages over larger firms in certain circumstances - for example in some service industries, and they have also been suggested to be responsible for spearheading new inventions/technologies in some cases. Where substantial development work is integral to the new product process however, smallness _per se_ may be a distinct disadvantage.[4]

One purpose of this chapter is to consider the small firm in relation to its _potential_ for growth and development[5] to endeavour to define whether such potential is, in fact, being utilised by a

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1. 'Enterprises into the Eighties' A Confederation of British Industry Smaller Firms Council Discussion Document, CBI - 1978

2. Ray, G and Hutchinson, P.J. (1983) _The Financing and Financial Control of Small Enterprise Development._ Gower Studies in Small Business.
Of an initial sample of 676 companies going 'public' between 1969 and 1973, the authors defined only 149, or less than a quarter as being 'small rapid growth companies'. Since companies going 'public' are, presumably, 'successful', this figure probably overstates the percentage of growth companies in the small firm sector as a whole.

3. See for example, Mason C M. 'The Development of New Manufacturing Firms'. _International Small Business Journal_ 3.2, 1984. In this authors sample of small firms he found "a small group of high fliers" accounting for less than 10% of the total sample.

4. Hawthorne, E.P. '_The Management of Technology_', McGraw Hill 1978

5. For an exploration of the investment behaviour of small firms see Hankinson, A. Doctoral thesis, Bath University 1977. 'The Investment Behaviour of Smaller Manufacturing Business Units in the Plymouth area 1970-1975'

majority of smaller firms. It is probably also important to elucidate those factors which might give smaller firms a comparative advantage[1] over their larger counterparts. Within these factors the formulation of policy and the implementation of strategies to fulfil those policies may be important.

The recent history of the British economy encompasses a change from slow growth through a period of rapid retrenchment, several years of low level activity[2] and a return to slow growth. In the change from growth to retrenchment, SFs may have been particularly vulnerable to the greater power of larger firms as customers and suppliers. However, one effect of the recession may also have been to make larger firms withdraw towards their 'core' activities.[3] In such cases, therefore, the market <u>segments</u> in which SFs are able to compete successfully may have increased in size as larger firms shed more peripheral activities. The 'small firm' as sub-contractor, licensee or independent supplier may therefore have gained an advantage in some instances and in some sectors.

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1. Small firms may be less successful at certain things than large firms in absolute terms but may have a comparative advantage if the larger firms choose not to carry out those functions themselves because they feel they may make better use of their resources elsewhere. This concept is explored in greater detail below.

2. Financial Times, 19 March 1982

3. Through promoting management buyouts of unprofitable subsidiaries, or other divestment activities. See for example Chiplin B and Wright M. 'A New Lifeline for Industry' <u>Accountancy</u>, December 1981 and Birley, S. 'Success and Failure in Management Buyouts'. <u>Long Range Planning</u>, Vol 17 No 3, 1984

The change from a slow growth to a non-growth or 'retrenchment' economy may also have had structural effects upon the 'small business sector' as a whole, in addition to affecting specific small companies. In growing market segments, competitive pressures might have been masked. However, as a result of the recession competitive pressures may have increased, for smaller firms, forcing them to search out opportunities on a more flexible basis. Such pressures might be anticipated to have increased the propensity of smaller firms to search for and enter new market niches with different products and to consider the use of new techniques, such as technology licensing, to obtain the products to carry out this process. As a major part of this chapter an empirical study is made to determine how important product/market flexibility had been in a sample of smaller firms.

Secondly, exploration was made of the comparative importance[1] of smaller firms across the full range of manufacturing industry.

Lastly, this chapter considers some of the features of small firms that may have direct relevance to their use of technolgoy licensing. Since licensing can clearly come about as a strategic choice, where alternative methods for obtaining technology are available, it is probably also important to explore the development of policy formulation in small firms. A second area of study

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1. In terms of employment and output related to Research and Development expenditure and capital expenditure per employee.

consists of evaluating whether such firms do have potentially greater flexibility than medium or large firms, which might increase the usefulness to them of licensing *per se*.

An exploration is therefore made within this chapter of the formulation of business policy in all firms, and the specific small firm factors which may impinge upon this process. A major aim of the chapter is to define whether in principle the strategic objectives of smaller firms can be changed more quickly than in larger firms.

B. CHARACTERISTICS OF SMALL FIRMS

1. Definitions

Several authors have remarked upon the difficulty of defining the precise meaning of a 'small firm.'[(1)(2)] A major problem relates to the very diverse sectors in which small firms operate. While, within manufacturing sectors,such measures as turnover or number of employees may yield an accurate comparison, it is probably unrealistic to endeavour to apply such measures across service sectors. For the purposes of this thesis, where licensing within manufacturing industry has been a main area of study, numbers of employees seemed a reasonable measure to use. This classification has not however, been used dogmatically, particularly in the empirical work, where an upper limit of 200 employees has been used as a guideline only.

Statistical means for defining 'small companies' may in some cases be less useful than other measures in understanding policy making structures. Behavioural definitions have also been suggested.

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1. Botton, J E. 'Small Firms - Report of the Committee of Inquiry on Small Firms', HMSO 1978. op.cit.

   The 'Bolton' report defined small firms in two ways. An "economic definition" encompassing firms with small market shares, managed by their owners and independent, and a "statistical definition" - firms with less than 200 employees.

2. Bannock, G. 'The Economics of Small Firms'. Blackwell, 1981

One definition which has not, to the authors knowledge, been proposed before, but which seems both logical and useful, defines the transition from a small firm as "that point at which a personnel manager is recruited".[1] This could also be a useful definition in the context of technology licensing, since it is an instance of the development of 'functional specialisation'[2], paralleling the recruitment of specialised licensing personnel to carry out that function.

2. Small Firms in British Manufacturing Industry

While the decreasing proportion of output accounted for by small firms appears to have been an historical trend[3], there are some reasons for believing that this trend may now have ceased.[4] The anticipated advantages of 'bigness' have not always been realised through economies of scale, and the recent recession may have made some of the larger firms look again at their strengths and weaknesses and decide to concentrate more on 'core' strengths while divesting non-mainstream activities.[5] Such changes might lead to opportunities for smaller firms to act as suppliers or

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1. Bossons, W. University of Bath Management School, Personal communication to the author, January 1982
2. See for example, Wyatt, S. 'The Role of Small Firms in Innovative Activity'. SPRU Sussex, 1982
3. The Bolton Report, op.cit, for example showed this decline continuing to at least 1968
4. Economist article, 'Britain's Small Businesses', 29 September 1979
5. Financial Times - Small Businesses Report on Management Buy-Outs, 3 June 1981

sub-contractors to larger firms. The effect of this changing climate on the policies of small firms might be anticipated to be a long term process however.

3. Ownership and Legal Status

One of the major definitions of the small firm made by the Bolton commission(1) was that the firm was "owner managed". This definition may be an important factor in considering how smaller firms are controlled, particularly with regard to policy decisions made by owner managers. It may be useful to consider the rationales behind decision making by such individuals. The Bolton Committee found that independence was a major factor influencing small firms owner/managers. The typical 'entrepreneur' however may have different objectives to fulfil. In his study of rapid growth companies, Ray(2) showed that both the objectives

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1. Bolton, J E, 'Small Firms', op.cit.

2. Ray, G H and Hutchinson, P J. op cit.
   The authors showed clear differences between growth and non-growth firms; the results of which are précised in the table below:

FACTORS	GROWTH COMPANIES	NON-GROWTH COMPANIES
Objectives	Growth Profit maximisation	Independence
Organisational structure	Delegated structure	Direct owner managed
Management style	Paternal and authoritative	Paternal and authoritative
Internal Accounting structure	Very strict cost control	Poor cost control
Historical and Forecasted Financial information	Very extensive	Poor
Key variables used in control	High	Low

and methods of achieving those objectives, were different for 'entrepreneurs' than for other owner managers. In particular, 'entrepreneurs' were prepared to relinquish equity holdings in their firms. This suggested that such individuals were prepared to accept outside influences more readily than other owner managers. Such influences could lead to the use of new techniques such as technology licensing as alternative methods of profit maximisation. However, in other smaller firms, the acceptance of such techniques might be less important.[1]

4. The Financial Characteristics of Small Firms

It is probably not relevant in this thesis to explore the role that financial constraints might play in the start-up of small businesses. Clearly however, sources and availability of finance are likely to have an important bearing in some cases on the decision by established small companies to use inward licensing in their new product policies rather than attempting to develop new products 'in-house'. Equally, the use of licensing 'out' may be affected by the firms requirement for quickly generated cash flow. The ability of small firms to raise finance for

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1. See for example 'Sargant Florence' The Logic of British and American Industry'. Routledge 1953. The author suggested that one reason for poor UK industrial performance was the large proportion of UK output controlled by family firms where profit maximisation was not the major objective.

innovation may be limited in such cases[1], and any method of reducing this limitation might be anticipated to be welcomed. Several studies[2] have suggested a low level of expenditure on innovational activities by small firms in general. However, a small proportion of small firms do appear to be highly innovative[3] and in such firms the easy availability of finance may play a crucial role.[4][5] Licensing of products or process technology by reducing expenditure on 'in-house' research and development might, therefore, be potentially attractive to those small, rapidly expanding companies with severe liquidity problems.

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1. Binks, M. Lloyds Bank Review, October 1979

   The conundrum facing small firms is summarised by Binks statement 'The smaller the firm, the larger the proportional increase in capital base required to respond to an increase in demand but the lower its ability to command loan and equity finance'. This probably applies equally to the new product development decision.

2. Bolton, J E. 'Small Firms,' op.cit.

3. Innovation in Small and Medium Firms. Report by OECD, February 1982.

   This report suggests that only 'from 10-20 per cent of small companies are engaged in turning out new products'.

4. Ray, G H and Hutchinson, P J. op.cit.

   The authors found that small firms which were most innovative and had rapid growth were also likely to have the severest cash flow problems.

5. Ray, G H and Hutchinson, P J. op.cit.

C. THE FORMULATION OF BUSINESS POLICY

1. Introduction

The concept of business 'policy' is subject to a number of definitions. Ansoff[1] relates it to strategy in terms of its role in the decision making process. For the purpose of this thesis, policy is considered to relate to the character or nature that the company wishes to adopt, while strategy is understood to relate to the means employed in realising this character. Strategic planning implies major long term changes in the way that the organisation operates.[2] Policy statements are probably usually of long term implication, defining the position of the firm within its environment. There are probably at least three major factors in any policy analysis, the firms' objectives, the methods by which those objectives will be attained and the constraints upon those objectives. At an operational level tactical decisions can be arrived at within broad strategic objectives, to develop particular proposals. In practice, the policy development of the company may be constrained by the objectives of top management while strategy and tactics may be developed at lower management levels in the organisation.

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1. Ansoff, I. '<u>Corporate Strategy</u>'. Pelican Books, 1965
   Ansoff suggested that ".....the meaning of policy is seen to be distinct and different. Policy is a contingent decision where strategy is a rule for making decisions. Thus while implementation of policy can be delegated downward, implementation of strategy cannot, since last minute executive judgement will be required."

2. Moyer, R. 'Strategic Planning for the Small Firm'. <u>J Small Business Management</u>, July 1982.

The formulation of business policy has been explored by many authors.[(1)] The major objective of the study being undertaken here is to define, briefly, how policy might be defined, to explore how this might relate to the situation of the smaller firm and how such policy might be translated into the development of new product strategies. It is suggested that the process involved in many smaller firms might arise in a more ad hoc manner than in larger organisations. However, some small firms clearly do develop formal strategies while some larger firms probably have none. Other authors have classified companies to overcome size related definitions.[(2)] In the context of this study, such classification is probably useful in defining sub-sets of firms with similar policy making structures.

2. Factors Impinging Upon Policy Decisions

Development of a 'business policy' by smaller firms is likely to be constrained by the environment in which they operate. The resources such firms can employ to undertake particular functions are also likely to impinge upon the strategies followed.

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1. See for example,
   Thomas, R.E. 'Business Policy, Philip Allen Publishers, 1977
   Ansoff, H.I. 'Corporate Strategy' Penguin, 1968
   Ackoff, R. 'A Concept of Corporate Planning', Wiley, 1970

2. See for example Carter, C.F. and Williams, B.R.
   'Industry and Technical Progress' Oxford University Press, 1957
   The authors suggested three types of firm, parochial, progressive and adaptive to describe different cultures within the firm.

Strategic development may therefore, usually be subject to the definition of realisable objectives contingent upon the means available to the firm and the constraints impinging upon it.

The more precisely the objectives of the firm can be stated, the more accurately can strategy be defined to fulfil those objectives. A primary objective of all companies is clearly to survive within their competitive environment. The 'robustness' of the firm, or its ability to survive in an environment where changes and threats develop through competitive pressure, economic factors and technological change may be a pre-requisite for the other strategic functions of the firm. However, survival should probably also be balanced against risk, since no business operation can be totally risk free.

Growth is frequently cited as an important strategic objective for firms. In this context growth may be important as a defensive mechanism against competitive rivalry. However, growth is probably often perceived to be an important function in its own right. This may be particularly important for the smaller firm which may be relatively 'unstable' because of the narrowness of its product lines , its lack of resources and its poor control over external environmental factors. In such cases, diversification away from very small market sectors and narrow product lines, may be important strategic objectives in decreasing risk profiles and overcoming growth barriers. Reaction to opportunities that arise, while not fitting any strategic objective apart from survival and growth, may also be an important means of development.

Adequately and realistically defined objectives are likely to take account of the means and constraints that the firm is subject to. The means available may include both physical and human resources. For the smaller firm, the sum availability of such resources may be more restricted than in the case of larger firms. However, it is suggested that reallocation of such resources to different or new tasks may be facilitated in smaller firms in some part, because of the lower degree of functional specialisation[1] than in larger concerns.

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1. Wyatt, S. op.cit.

3. Policy Making Structures and Firm Size

As firms grow in size, their policy making and management structures clearly have to evolve to take account of the increased complexity of the operations over which they have control. The number of stakeholders[1] is likely to grow and the amount of information impinging upon particular policy decisions may also increase. Thus the firm is likely to become subject to an input of new ideas and techniques in line with the increase in its size. Pressures to diversify both physically and functionally, and utilise new techniques such as technology licensing, may arise from within the firm through pressures to extend product lines or markets, or externally as proposals from third parties, suppliers or customers. However, many smaller firms may be ill equipped to evaluate such information realistically.[2]

Growth is likely to bring an increase in the number of individuals involved within the firm and hence an increase in the complexity of its corporate culture. The number of skills that are available to it internally may also increase. Such development may also lead to an increase in the number of new ideas that arise within

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1. Stakeholders are defined as all individuals and institutions having a 'stake' in the business, i.e.owners, managers, suppliers, customers etc.

2. See for example, Videm, J. 'Communicating Technology Knowledge to Small and Medium Sized Companies'. International Small Business Journal, 3.1.1984.
   The author suggests that "in many smaller companies the managers lack the competence and the resources necessary to acquire future oriented background information about markets and technology".

the firm. This may be important in defining how policy structures develop within a growing firm and be relevant in identifying whether the use of techniques such as technology licensing usually arise as an internally based strategic decision process or as the result of external stimuli.

The experience of those in charge of company policy may comprise the most important single influence upon the company's strategic development. Each individual is likely to bring to the firm an accumulated experience which may complement other individuals' skills within the organisation. However, it is clear that every firm develops its own culture, style and ethos [(1)], unique to itself and probably comprising more than the sum of its constituent parts. Consideration of this culture may be crucial in developing strategies for company development, whether this is a formalised process or not.

In many cases very small firms do not appear to undertake formal strategic planning [(2)]. One individual owner manager may control all the functions of the firm, both in its day to day operations and longer term development planning. Since all strategic functions are subsumed within one individual, the opportunity

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1. Edwards, J.P. (1977) Strategy Formulation as a Stylistic Process. International Studies of Management & Organisation. New York.
2. Rice G. and Hamilton, R. 'Decision Theory and the Small Businessman'. American Journal of Small Business. July 1979

cost[1] of understaking any non-mainstream activity, such as technology licensing, may be high. Thus potentially profitable activitiesmay not be undertaken.

While concentration of decision making in one individual may tend to make the small firm more flexible and may lead to effective long term planning, even though this may not be formalised, such concentration may also exert a limiting influence upon the firm. Clearly, as the firm grows in size, both the organisational and policy making structures have to be adapted. This change has been characterised as development of the organisational structure from the highly centralised 'hub and wheel' type [2] to a structure where profit or investment centre managers have a degree of autonomy. Such decentralisation might be anticipated to lead both to an increase in the use of new and different techniques (such as licensing) while decreasing the potential for effective strategic management

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1. Opportunity cost is frequently employed in the context of investing physical resources in projects. Utilisation of resources in one project prevents their use in other projects which might yield a higher return. This is an opportunity lost.

   The time of the Chief Executive in smaller firms may be a particularly valuable resource that can be employed in various functions only at the cost of ignoring other functions. In the hierarchy of importance in the functioning of the firm, day to day administration may be perceived to be more important than longer term planning, licensing, or other non-mainstream activities.

2. Lievegoed, C.L. '<u>The Developing Organisation</u>'. Tavistock, 1973

However, development of a hierarchical structure to levels of strategic planning, administration and operation,[1] might lead both to an increase in the effectiveness of strategies to fulfil policy objectives and to an increase in the development of new techniques per se.

As the size of the organisation increases, more specialists are likely to be recruited, adding more 'experience' to the firm, while at the same time reducing the opportunity cost of top management carrying out non-mainstream activities. This might suggest that both 'top down' and 'bottom up' pressures would arise to develop new sources of expertise and the utilisation of innovative forms of business development. It might, therefore, be anticipated that there may be a minimum firm size below which both diversification and the use of licensing would be likely to be too costly in management time for the smaller firm to undertake successfully. If this is the case, there may be a threshold[2][3] above which smaller firms may be more likely to utilise such techniques.

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1. Anthony, R.N. and Dearden, J. 'Management Control Systems' 4th edition, R.D. Irwin, 1980

2. Threshold firms can be defined as those firms which have reached a plateau in their development. This plateau can be organisationally or technologically based and conforms to the transition from hub and wheel to differentiated management structures, from non-diversified to diversified product lines etc. These transition points may overlap with each other.

3. Steed, G.P.F. (1982) 'Threshold Firms' - Backing Canada's Winners. Science Council of Canada. Background Study 48.

A threshold firm may have reached a managerial, technological or financial threshold, requiring resources or reorganisation in one of these areas to continue to grow. Managerial restrictions could arise if owner managers were unwilling to relinquish any control over the decision making processes within their firm. Technological thresholds might arise as a failure of the firm to obtain sufficient resources to compete further in its current markets. Licensing of technology 'in' might be one method of overcoming this threshold, as could diversification into another market. Financial restrictions could arise as the result of the reluctance on the part of owner managers to relinquish equity holdings to release funds to allow their firms' to develop. All these factors suggest a strategic as well as an economic element in the overcoming of threshold barriers.

It is therefore suggested that the development of policy making structures in conjunction with an increase in firm size is likely to be an important factor in understanding the use by smaller firms both of technology licensing and in the development of diversification strategies. However, such strategies may also depend to an extent on the characteristics of the company product lines and the markets into which those products are being sold. It may, therefore, be instructive to consider the characteristics of particular product types in more detail through consideration of product management <u>per se</u> within the strategic management process.

4. Development of New Product Policies by Small Firms

Two underlying instincts of small company managements were suggested to be indepdence and growth.[1] Possibly a majority of small firms appear content merely to survive, fearful of the changes that may be required of them and the risks they may run in any policy of growth or diversification.[2] For such firms, the management of technology portfolios and the development of new product policies may frequently be more reactive than proactive processes. A policy of survival may involve the smaller firm, at some point, in a search for new products because of ageing product portfolios or through other external pressures over which it may be able to exert little control. More active, growth based firms, in contrast, probably develop more proactive new product policies.

Actualisation of new product strategies however, may be a complex process in which the advantages of 'in-house' new product development over the purchase of technology or products

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1. Bolton, J.E. 'Small Firms'. Report of Committee of Inquiry on Small Firms, op.cit.

   The Bolton report showed that a desire for continued independence was the major factor behind decisions made by many small firm managements.

2. Hankinson, A. Unpublished PhD thesis, University of Bath, 1977.

   Hankinson for example, found that profit optimisation was <u>not</u> a goal of the majority of small firms, (even though this was often stated to be the case) from outside the firm may be difficult to evaluate. Current technological and design competence may play a more important role in the decision to innovate in a particular direction than purely marketing considerations would suggest. The firm may therefore be constrained to an extent by its own strengths and weaknesses. Realistic recognition and evaluation of technological competence may be important, particularly where diversification is being contemplated. Defining such competences however, may be difficult for small firm managements.

Possible pressures leading smaller firms to develop new products are explored below in the context of their source and impetus. Such pressures can probably be divided into those emanating from outside the firm and those emanating from within it.

4a. External and Environmental Factors. External forces over which the small firm has no control may be important in determining the new product development (NPD) policies of a majority of small firms. While the role of ad hoc meetings and approaches by external bodies has already been mentioned, other external factors likely to be important in the NPD decision include general economic conditions, large company competitive pressures, market pull and technology push factors.(1)

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1. A further exploration of market pull and technology push forces is made in the context of 'technology' in Chapter 4

Cyclical economic forces may, in some instances, stimulate small firms to consider developing new products. In times of recession the need to develop new products, symptomised by falling sales in long running product lines, may become more apparent.[1] Conversely, rising economic activity may also lead to an increasing demand for new products, allied to a greater ability by customers to pay for enhanced products. Both these pressures might be anticipated therefore to lead to an increase in NPD activity.

Competition from other firms may also increase during recession. In expanding markets, larger firms may be content to ignore small market segments and concentrate their strengths in other areas.[2] In recession however, smaller market segments may become more attractive as a method of utilising spare capacity.[3] This would tend to increase larger firm pressure on small firms. Recession may also decrease competition from larger firms in some cases, however, as non-core and subsidiary activities are divested.[4]

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1. CBI, 'Industrial Adaptation in the West Midlands' CBI publication, January 1982. This CBI survey found that the 1980/81 recession had stimulated new product development in many smaller firms where little NPD had previously been carried out.

2. Their comparative advantage lying in other areas.

3. See for example Binks, M and Jennings, A. 'New Firms as a Source of Industrial Regeneration'. Paper presented to the Sixth National Small Firms Policy and Research Conference University of Durham, 1984

4. An increase in divestment by larger firms of unprofitable or non-integrated divisions also appears to be the result of recessionary pressures in some instances.

   See Scibor Rylski M. 'How to Innovate', New Scientist 7 January 1982

Market pull factors, as suggested above, may favour smaller firms in competition with larger firms. Smaller firms may be able to respond more quickly to market opportunities than large firms and may also be more likely to recognise such opportunities. Evidence of a market need may also reduce the risks involved in developing a new product. Recognition of a market need is, probably, also more likely by smaller than larger company managements. The smaller firm's management is likely to be closer to the markets and customers it serves than larger firm decision makers, divorced by layers of administration from final users of its products.

Technology push factors have frequently been cited as leading to new product development.[1] Where costs of innovation are high however, technology push factors are probably less relevant to many smaller firms. In such instances smaller firms may only be able to exploit technologies by licensing or other joint ventures with larger firms.[2]

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1. See Chapter 4

2. Bolton, J.E. 'Small Firms'. Report of the Committee of Inquiry on Small Firms, op.cit.

   (a) The 'Bolton Report' stated (page 53), "Possibly a majority of innovations, therefore, arise from a little understood process of movement of people: through small firms being acquired by larger firms or acquiring licences from them: by staff leaving one company and joining another...."

   (b) The 'Bolton Report' also quoted a study by Langrish, Gibbons and Jevons (Quoted in M Gibbons, and D S Watkins - Innovation and the Small Firm, R & D Management, January 1971) stating that of 158 important technical ideas contributing to the innovations which won the Queen's award for technological innovation in 1966/67, 102 originated outside the firm.

4b. Internal and Firm Specific Factors. Decisions by smaller firms to develop new products are likely to reflect the unique characteristics of those firms and the historical pressures that have led to current market positions. Historical factors will have shaped the current product portfolio and the style and ethos[1] of the firm. Internal pressures impinging upon the new product decisions of the firm may also be a reflection of such historical factors. Firm specific and internal factors are considered under the following headings: size specific factors, company type and product portfolio factors.

Decision making processes in small firms may differ markedly from those in larger concerns.[2] This may be particularly important in the decision to develop new products, which may also be constrained by the capacity of the firm to carry out research and development 'in-house'. The resources available in smaller firms for such research are clearly likely to be less extensive than those available to larger concerns. R & D may, therefore, be more 'development' than 'research' based,concerned with improving particular products rather than as an ongoing process. Lack of resources in the R & D field may also be more of a constraint on the innovation process than in invention. Many inventions may, therefore, go undeveloped in smaller firms through a lack of resources and available skills.

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1. Thomas, R.E. 'Business Policy', Philip Allen Textbooks, 1977

2. Bolton, J.E. 'Small Firms'. Report of Committee on Small Firms, op.cit.

An inability to evaluate opportunities 'in depth' through a shortage of resources in the organision, could also be important in some instances.

The style and ethos of the firm may also have an effect on its new product development profile. It was suggested above that some small firms may develop new products as a response to outside stimuli rather than through any strategic planning process. This might suggest a classification of smaller firms into two groups - the fast growth, professionally managed firm, probably comprising only a small proportion of the total population of small firms, and the majority of small firms comprising those which react to change and pressure as it arises. The latter may be less likely to carry out strategies for optimising their potential.[1] While the former group may usually have a continuing commitment to the development of new products, the latter firms may arrive at the new product development decision in a much less planned and 'reactive' manner.

Product portfolio pressures may force the firm into the new product development process. Factors leading to a decision to develop new products might include a realisation that product lines are too narrow, leading to a desire for risk reduction through diversification, or the perception by managements that products are obsolescent. While the concept of the product life cycle is probably not universally accepted, and may not be

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1. Hankinson, A. op.cit.

applicable in every case, technological advance can clearly render products obsolete in some cases.[1] The risk to the smaller firm in concentrating upon only one product line is therefore likely to be considerable. Pressure to develop new strategies may arise suddenly, after long periods of unplanned growth which have led to narrow product portfolios or, conversely, to too diversified growth leading to an unbalanced product portfolio. A study of the range of diversification levels in a sample of smaller firms comprises an integral part of Chapter 3.

The percentage of small firms engaged in developing and introducing new products at any one time is probably relatively small.[2] Many smaller firms, particularly those operating in small market segments, geographically restricted, or otherwise protected markets, may have no immediate impetus to new product development. The ability of small firms to undertake the development of new products may also be restricted by their technical competence. In such cases purchase of technology under contract may be one method of overcoming restrictions, allowing new product areas to be entered more easily.

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1. Kotler, P. 'Marketing Management'. op.cit. Prentice Hall 1976.

   "The product life cycle is an attempt to recognise distinct stages in the sales history of the product."

2. OECD report on Innovation in Small and Medium Sized Firms, op.cit.

   This report suggests that only 10-20% of small firms are engaged in new product development.

One 'in-house' factor that may be crucial in the successful introduction of a new product to a firm is the 'product champion'.[1] It is suggested that such individuals play a major part in overcoming resistance to change and introducing and implementing development of new products within the firm. The position of the product champion within the hierarchy of the firm may be particularly relevant in the acceptance of the product by company management.

5. Product Life Cycles and the Implementation of Business Policy

Formulation of an effective product policy may be problematical for smaller firms with small product portfolios. The objective of such a policy may be to keep an efficient mix of products in terms of age, complexity, market and technology profiles. To achieve this consistently may be difficult in view of the low functional specialisation of most smaller firms.[2] Diversification into new markets or the utilisation of new process techniques might be anticipated to be particularly risky for smaller firms.

To overcome the difficulties of developing effective new product strategies, various techniques have been proposed to assist companies in analysing and controlling their product portfolios.

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1. Kotler, P. 'Marketing Management', op.cit.
   "....most new product ideas do not get anywhere without a product champion.'

2. Wyatt, S. op.cit.

In the context of this thesis the concepts of the product life cycle and the 'experience curve' may be important. Both of these concepts probably have relevance to the use of licensing, and the role of diversification utilising licensing techniques. However, a possible weakness of techniques such as product life cycle analysis may be that while evaluation of current product portfolios may be effective, definition of suitable strategies to overcome identified deficiencies may be more problematical.

The Product Life Cycle

The product life cycle is a familiar concept[(1)] that has been subject to a varying degree of 'popularity' both in its acceptance and in its use. It is probably a simple concept to apply to many products since the volume of sales of some products do follow a pattern that can be broken down into introduction, growth, maturity and decline.[(2)] It is not an objective to explore in detail the arguments for and against the use of 'life cycle theory' here, since this has been adequately covered elsehwere.[(3)] In the context of this thesis however, the life cycle concept is important, and relevant both to the use of licensing by smaller

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1. See for example:
   Kotler, P. '<u>Marketing Management</u>' Prentice Hall, 1976
   Staudt, T.A. and Taylor, D.A. '<u>A Managerial Introduction to Marketing</u>', Prentice Hall, 1976

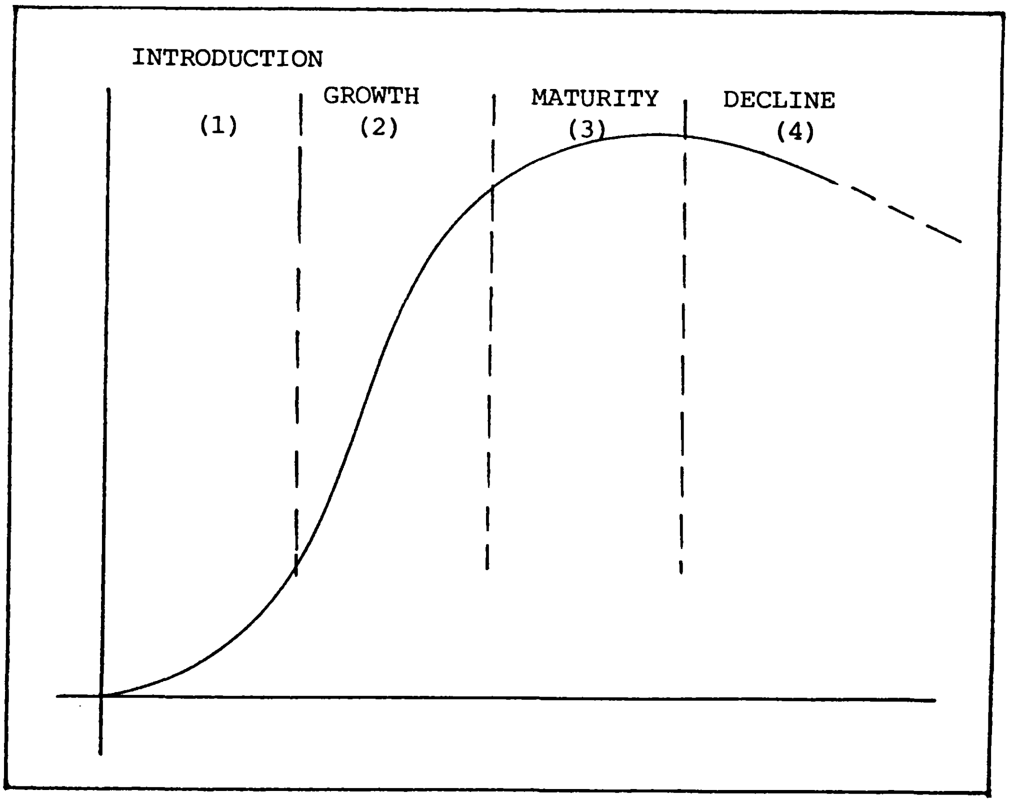
2. See Figure 2.1

3. See for example:
   Polli, R and Cook V. 'Validity of the Product Life Cycle' <u>Journal of Business</u>, October 1969.
   Porter, M.E. '<u>Competitive Strategy</u>', The Free Press, 1980

firms and the utilisation of diversification strategies in such firms, since 'life cycle pressures' have been suggested as reasons for the use of technology licensing within some companies.[1]

It is suggested that life cycles pressures may be responsible for triggering firms' consideration of both inward and outward licensing in their product and market strategies, and for diversifying into new fields. However, this may often be a reactive rather than a proactive process.

Figure 2.1 Stages of the 'Product Life Cycle'



1. See for example:
Kotler, P. 'Marketing Management' Prentice Hall, 1976
Staudt, T.A. and Taylor, D.A. 'Managerial Introduction to Marketing', Prentice Hall, 1976

A major objection to the use of the product life cycle lies in defining ,for particular products, when any particular stage has been reached. The introduction of new technology for inclusion in, or in the production of, a particular product, could change its characteristics, leading to a different classification within the life cycle. Technology licensing could in principle be important in this process in obtaining product or process technology, thus changing the length of time that product remained in any particular stage of the cycle.

A strategic objective of many firms might be anticipated to be a portfolio of a 'mix' of products at various stages of the product life cycle, with an emphasis on stages 1 and 2. This might allow planned replacement of obsolescent products. However, it has been suggested that many smaller firms carry out no such policies and that investment in the development of new products arises in a reactive 'crisis management' sense, rather than as part of a planned strategy.[1]

Work by the Boston Consulting Group (BCG)[2] suggests a framework of product matrices to assist firms in defining the position of products in their portfolios. This suggests products can be classified through an analysis of their market share and the characteristics of the market as stars (S) - fast growing market leader products with high cash requirements to finance

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1. Hankinson, A. Investment Behaviour of Smaller Firms. Unpublished PhD thesis, University of Bath, 1977

2. For example see: Day, G.S. 'A Strategic Perspective on Product Planning' Journal of Contemporary Business, Spring 1975

growth; cash cows (C) - dominant though mature products generating large amounts of cash; problems (P) - rapid growth products with high level of product competition leading to high cash requirements; and dogs (D) mature products with small market shares.

The importance of the BCG analysis in the context of this thesis is in its potential impact upon small company decisions to diversify and/or licence 'in' or 'out'. If products can be classified as cash generators or users, decisions on the utilisation of licensing may be facilitated. Cash users could be licensed 'out' to become cash generators while licensing technology 'in' might also convert cash users to cash generators in some cases. In the empirical analysis in Chapter 6, study is made of the practical implications of this process in small firm licensing. Initially, however, it is relevant to consider how the BCG analyses could relate to licensing within the product life cycle groups above.

Products at the Research and Development stage, high cash users, potentially provide a supply of licensed products. High research and development costs may force a company to reconsider its product development strategy. However, others may possess the resources to develop that product further,[1] thus the potential to license 'out' may exist. Conversely a smaller firm might consider licensing 'in' a part developed product from another firm that had decided to abandon further development of a product because of poor 'fit' with organisational objectives.[2]

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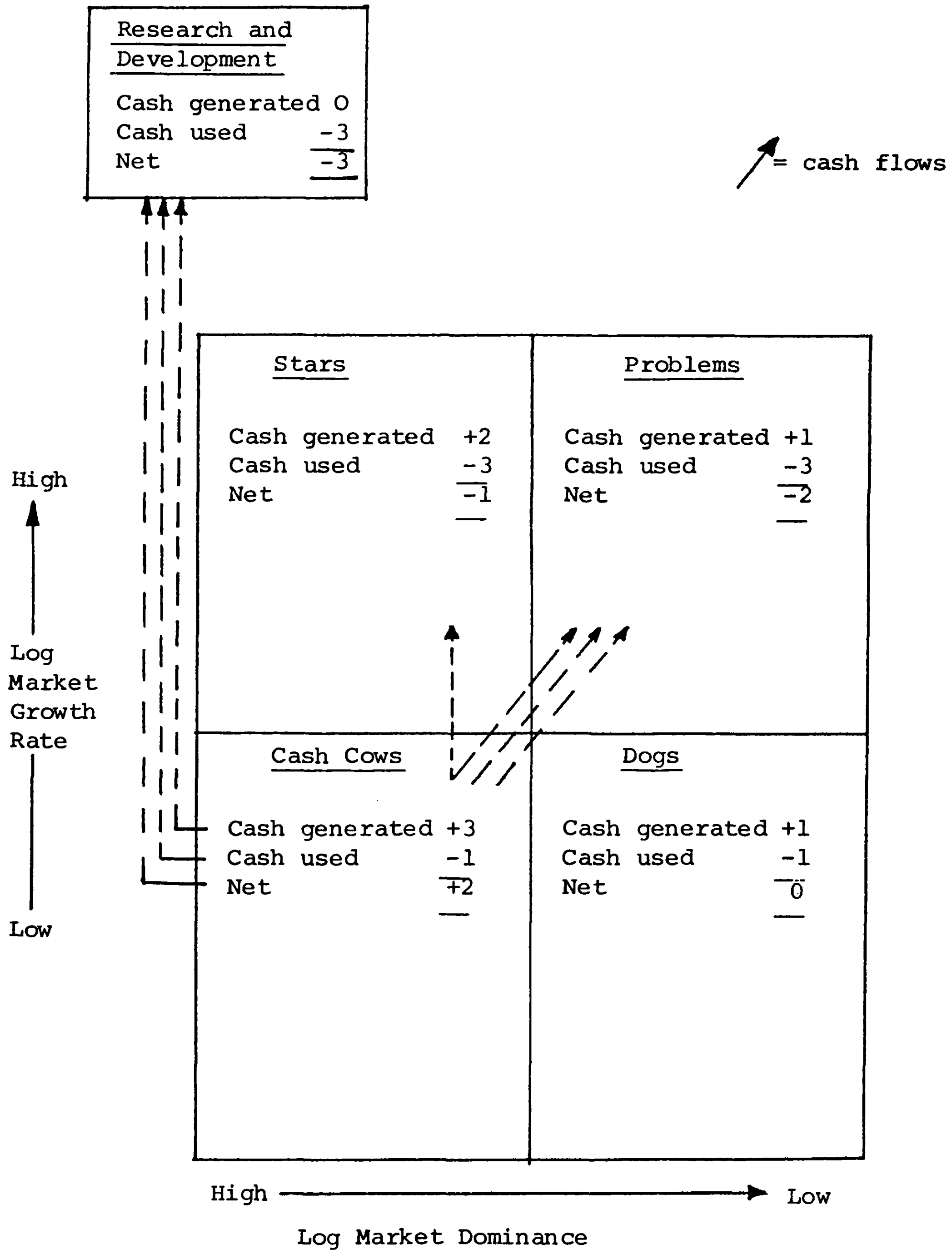
1. The implications of this are considered in detail in Chapter 6.

2. Possibly a large firm.

Figure 2.2 Describing the Product Portfolio in the Market Share Growth Matrix



Adapted from Day G.S. 'A Strategic Perspective on Product Planning, Journal of Contemporary Business, Spring 1975

Figure 2.3 Product Portfolio Analysis and Licensing Potential

Research and Development

Potential for:

Inward Licensing: HIGH
Outward Licensing: HIGH

STAR (S) Potential for: Inward Licensing MEDIUM to LOW Outward Licensing HIGH	PROBLEM (P) Potential for: Inward licensing LOW to MEDIUM Outward licensing LOW to MEDIUM
CASH COW (C) Potential for: Inward licensing MEDIUM to HIGH Outward licensing MEDIUM to HIGH	DOG (D) Potential for: Inward licensing LOW Outward licensing LOW to MEDIUM

Licensing 'in' of 'Star Products' for the smaller firm is likely to be problematical. If another company lacks the resources to develop the product it is unlikely that most smaller firms would possess those resources. However, the product profile might be very similar to company products, leading to a good fit with marketing or production skills, a lowering of costs to the purchasing firm and hence a successful product. Conversely, the potential for a smaller firm to license a 'star' product 'out' is likely to be high, and could be an attractive strategy if 'in-house' resources were not available to develop the product to its full potential.

'Cash Cow' products could be attractive to smaller firms to license 'in' if suitable licensors could be found.[1] However, licensing such a mature product 'in' could also be problematical in view of the dangers of obsolescence. However, as a short term, crisis measure, such a licensing agreement could be effective in quickly improving company cash flows. For licensing 'out' 'cash cow' products may be attractive to licensees, but less attractive to small company licensors, if the dangers of setting up a competitor in the market are considered. However, out-licensing a mature product could be an effective strategy in increasing its already high cash generating effects and in providing further resources for new product development.

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1. Possibly from a company in a foreign market, which did not intend to export that product.

'Dog' products clearly have little potential for inward licensing, unless they can be used to fill a gap in a product line, thus generating potentially higher incomes for the licensee than the licensor was able to achieve. In general however, such products are probably unlikely to be attractive to license in. Conversely, it might be anticipated that licensees would be difficult to find for 'Dog' products. However, licensing into other markets should be a method of improving their performance. This could be particularly true for markets less technically advanced than the licensors, and protected by tariff barriers. Out-licensing may be a method of upgrading a 'Dog' to a 'Cash Cow' categoristion within that market.

The BCG model clearly does have application in the analysis of products with regard to their licensing potential. This is explored in more detail in Chapter 6. It does seem possible that BCG/licensing analyses could be used in some cases to assist smaller firms in successfully managing their product portfolios with the strategic objective of raising the profitability of particular products.

The Experience Curve

Development of the analysis of product market share as a proxy for the accumulated experience of the producing company within that market suggests that a relationship can be established between unit costs and accumulated production volume. The Boston

Consulting Group (BCG)[1] suggests that since price levels within market segments tend to be similar for similar products, profitability of a particular company is likely to rest upon cost levels.[2]

The relationship suggested is demonstrated in Figure 2.4 below. and subsumes a learning function, specialisation and economies of scale. As total units of output or 'experience' increase, unit costs decrease by a constant percentage, usually stated to be between twenty and thirty per cent.[1] The implication of this finding is that if a company can become dominant within its market segment it can reap high profits, as Figure 2.5 suggests.

It is probably unnecessary here to review the validity of the 'experience curve' in detail. Several studies have reached broadly similar conclusions with regard to its use.[3] One of the major objectives of inward licensing agreements is clearly to obtain the 'know-how' of the licensor company. In the context of this thesis such purchase of experience is likely to move the profit position of that firm, with that product, down the experience curve as shown in Figure 2.5. It may be relevant therefore to consider the use of licensing as a competitive tool which might allow smaller firms to break through both size and research expenditure thresholds and to compete successfully with other, larger firms.

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1. Boston Consulting Group. 'The Experience Curve Reviewed: Why does it work.' BCG publication, 1974
2. Johnson G and Scholes, K. 'Exploring Corporate Strategy' Prentice Hall, 1984
3. Conley, P. 'Experience Curves as a Planning Tool' IEEE Transactions, June, 1970

Figure 2.4 The Experience Curve

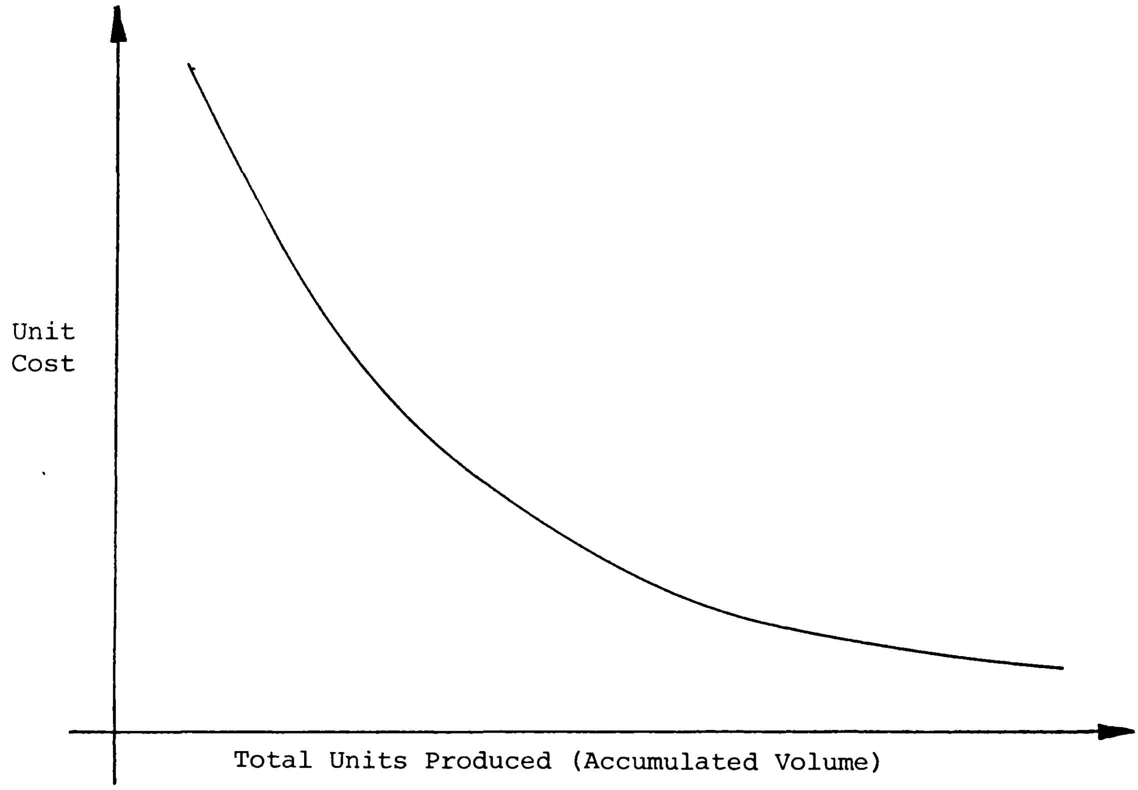
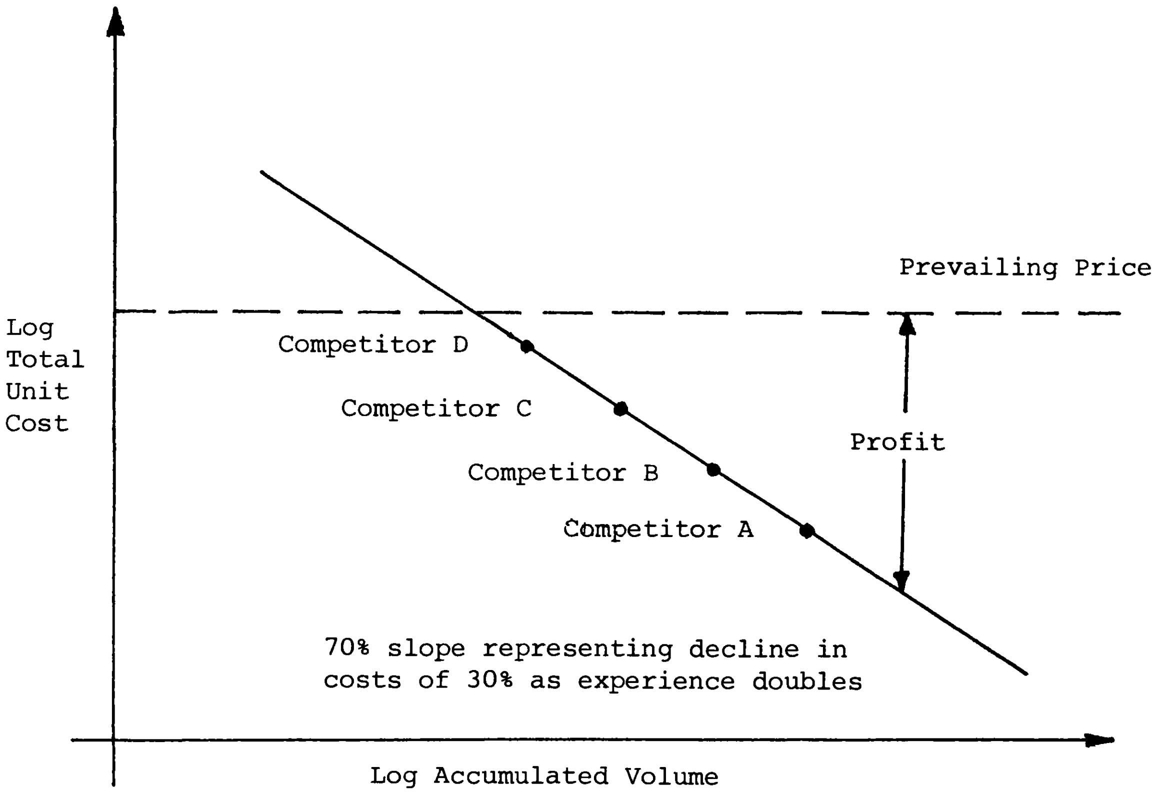


Figure 2.5 Cost Experience Curve - Profit Levels



D. OTHER SMALL COMPANY POLICY ISSUES

1. Introduction

It has already been suggested that the environment in which small firms are operating may be becoming more competitive, particularly for firms in innovative industries. A possible reason for this may be the increasing costs of new product development. Small firms may however, have certain advantages which may make them able to overcome such problems to an extent. Small firms may be able to fill gaps in markets where larger firms are unwilling to become involved. Larger firms may have reasons for not wishing to expand into other small sectors. Innovation, for example, may be an unattractive option to a monopolistic large company, making reasonable profits.(1) Any major innovation within the industry may make its present capital investment obsolete. In industries where most products are specialised and are produced in small quantities, customised for particular requirements, the SF may, however, be able to compete on more equal terms with larger firms able to call on greater resources.

It is therefore, one purpose of this section to endeavour to define which policy issues are important in a further understanding of small firms' competitive positions, with particular regard to

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1. A Review of Monopolies and Mergers Policy, Cmnd 7198, HMSO, May 1978

the effect these policy issues may have on any decision to employ other peoples (licensed) technology.

2. Role of the 'Corporate Plan'

Most small firms probably do not have a written corporate plan.[1] However, the absence of such a plan may indicate a lesser requirement for planning in the smaller firm rather than any lack of planning. Larger firms probably have to organise their resources on a more structured basis. A requirement for greater co-ordination and planning may therefore be more a reflection of the larger firms' requirement for time, in moving into new areas. In industries where product life cycles are measured in years, changing operational direction is likely to be a lengthy process. The smaller firm in general is probably not subject to the same level of constraints. Corporate 'plans' may frequently exist in SFs but not in a structured form. However, it has also been suggested[2][3] that many small firms innovate through necessity rather than planning. However, many SFs may also be able to react quickly to take advantage of opportunities in the market place. In this process, licensing might be one method of obtaining a new technology quickly.

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1. Bolton, J.E. 'Small Firms' op.cit
2. OECD Report - op.cit. "SFs ..... are driven to it (innovation) by rising costs and unexpected competition"
3. CBI Report - op.cit.

3. Factors Pertaining to Flexible Response

If changes in the market place are increasing comparative pressures upon smaller firms, what factors might be favourable to them in meeting the challenge of increased competition? It is suggested that potentially, SFs may be more flexible than larger firms in meeting changing conditions and pressures. If this is the case, small firms may be able to react to increasing competition or other factors by switching their resources more quickly than could large firms. Such potential flexibility might come about through several factors.

(i) Product Market Mobility

Many small firms supply markets in which their market share is extremly small.[1] They may therefore have a relatively small 'investment' in that market. The study carried out to measure the extent of diversification in small firms[2] suggested that many SFs do appear to operate in several different markets and this might suggest that entry by them into new (and by inference also exit from old) markets may be a relatively 'costless' process in many cases. If only a small market share is aimed for by the company, particularly in those cases where investment in capital equipment is low, it is suggested that many small firms may find moving from

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1. OECD - Small Firms and Innovation, op.cit.

2. See diversification, Chapter 3

one product/market to another relatively easy, particularly where major skills lie in marketing related disciplines rather than in any particular technological expertise. In such instances, licensing 'in' of a product might be one method of acting flexibly, particularly where the product in question did not require further development for exploitation within the new market.

(ii) Overheads/Investment

It was suggested above that small investment in capital equipment might make smaller firms potentially more flexible than larger firms with large capital investment. Smaller firms may in any case be less willing to seek capital for investment purposes when labour can be substituted.(1) For labour intensive firms there may be an ability to move that labour into other activities at a relatively low cost. This could be particularly important if the skill level required for the new activity was also relatively low. Since smaller firms tend to have less labour organisation(2) than larger firms, such a shift into new activities might be more easily accomplished.

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1. For example the garment industry is characterised by small low wage companies, employing casual labour and with low capital intensity, but able easily to move from one product line into another as fashion changes dictate.

2. Bolton, J.E. 'Small Firms' op.cit.
"..... a very much smaller number of small than large firms are unionised."

Smaller firms may also be more efficient in their use of manpower than larger firms. This could arise because management of a small company is likely to have 'in depth' knowledge of the functions being carried out by each employee. There may therefore be less likelihood that people will be 'carried' by the company. As size rises, this may become less true.[1][2] Secondly, smaller firms are probably less likely to have sufficient funding available to hold (for example) large stocks of material or work in progress.

(iii) Speed of Decision

Many independent small firms as defined above are owner managed. In such firms, the amount of consultation needed within the firm before particular decisions are made is likely to be less than in larger organisations where investment or new product proposals may have to be channelled through several 'decision making' structures in the firm. In the former case, the decision maker may also often be the project initiator. Potentially, therefore, the SFs reaction time to particular proposals is likely to be shorter than in larger organisations.

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1. As size rises, the number of non-productive employees is also likely to increase. This concept corresponds to the suggestion above of a particular size being reached before a personnel manager is recruited, at which point the number of 'indirect' staff may increase sharply.

2. A converse possibility of this is that larger firms may gain increased flexibility by being able to tap new sources of finance, credit, etc. and to enter markets that, as a SF, they might not have been able to tackle.

(iv) Market and Technology Pressures

While it was suggested above that SFs may be potentially more flexible than larger firms, external economic pressures may also force them towards acting in a flexible manner in practice.[(1)(2)] Such market push pressures may also be heightened by 'technology pull' factors as a result. An increase in the number of programmable machine tools and robots seems likely to reduce the costs of short production runs in specific areas.[(3)] Such techniques might be anticipated to reduce the advantages of 'mass production' processes, and widen the product scope of smaller firms in competition with larger concerns.

4. Reactive and Proactive Factors - Market Control

It was suggested above that many larger firms might find it difficult to move quickly from one market to another because of investment in current markets. However, since many such firms have large market shares they may be able to control market pressures in some cases. In those industries where several large

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1. OECD Report - op.cit.
2. CBI Report - 'Industrial Adaptation in the West Midlands' January 1982. CBI West Midlands Region, op.cit.
3. Economist, 29 August 1981, Robots are Coming to Industry's Service

   "...for others (small firms) robots are forming the cornerstones of flexible manufacturing systems. These are combinations of robots and computer controlled machine tools which bring the benefits of automation to the production of small batches of parts".

firms predominate (e.g. the cement industry), larger firms may be able to exert considerable control.[1] Such proactive behaviour is probably not usually open to smaller firms operating in more oligopolistic markets. They may therefore be forced to develop more reactive strategies except in those cases where they have a large market share of a small market. Even in these instances, however, predatory behaviour by larger companies may force a change in direction. Lack of any control over markets may be an incentive for the smaller firm to search for products in which control might be enhanced. This might lead to diversification into small market segments where it could build up a relatively large market share. An alternative strategy might consist of entry into a market where a large number of similarly sized firms were competing on equal terms. Such pressures might suggest that SFs might be less likely to enter markets in which one or more large firm already had a large market share, unless the market could be further segmented to give the SF a comparative advantage. In entering such market segments, licensing might be considered, since for very small market segments 'in-house' development costs might be greater than the profit potential for particular products.

5. Comparative and Absolute Advantage

If SFs do endeavour to ensure stability, as suggested above, by entering markets over which they might exert some control, it might be anticipated that they would be heavily represented in

1. 'A Review of Monopolies and Mergers Policy'. Cmnd 7198, HMSO, May 1978, p.14

those markets where they might have either an absolute or a comparative advantage over larger firms. Such representation might occur as a strategic decision by SFs to enter such markets or occur through market forces effectively denying their entry into certain markets.

In exploiting comparative advantage, smaller firms may be able to operate successfully in markets where larger firms do not wish to become involved for reasons which might include the opportunity cost of capital.[1][2] Small market segments might not be attractive to larger firms.[3] While larger firms could successfully compete against small firms in those market segments they might have little reason to do so if their total return was likely to be small.[4] Large scale capital investment by large firms in particular products and market sectors may mean that they may find it more profitable to develop current product lines than innovate into other small market segments. Such market segments might be anticipated however, to be more attractive to smaller firms. Recent divestment decisions by larger companies,

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1. Thus by entering a small market segment the larger firm may forgo more profitable opportunities elsewhere.

2. G G Daggit - Research and Development for Full Employment New Scientist, 7 January 1982, p.9.

   Daggit uses the term 'comparative dynamic advantage' to describe the process of choosing goods that others will not be able to produce for some years. In the terminology adopted here this would be defined as 'absolute advantage'.

3. OECD - op.cit.

4. General Electric Corporation of the US, for example, is quoted as not considering any market in which a turnover of more than twenty million dollars cannot be quickly achieved.

characterised by management buy-outs and sales of 'non-core' activity subsidiaries may be increasing the scope of potential operation of small firms.[1] Such sales may not be confined to operating divisions but could include specific technologies under licence.[2] However, successful development of a previously small market segment by small firms might cause reappraisal and entry by larger firms in some instances. The microcomputer market was characterised by small innovative entrepreneurial companies whose success in developing applications for the new machines caused larger companies such as IBM[3] to enter a market in which they had, hitherto, not operated.

While comparative advantage may work to a small firm's advantage in some cases, there is clearly always a possibility that larger firms may enter their market sectors at any time. This might make smaller firms with one successful product rather vulnerable. In some other sectors however, SFs may have an absolute advantage. Such markets may be characterised by a degree of specialisation or customer service that the larger company may be unable to provide at an economic cost. In such instances it is probably unlikely that larger firms will try to enter the market. Such markets may, however, be characterised by high levels of competition and low levels of market control.

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1. See for example, Management Buy-Outs - A Growth Business, FT Report, 1 May 1981

2. See Jasper, D.P. 'Technology Audit' in Lowe J and Crawford N K Innovation and Technology Transfer for the Growing Firm Pergamon Press, 1984

3. Financial Times, A Success Story that Surprised the Giant, G de Jonquieres, 18 January 1981.
   Small companies utilising the latest technology and spearheaded by such firms as Apple Microcomputer, built up a market worth more than a thousand million dollars a year in the USA before large companies such as IBM entered the market.

6. Licensing in the Development of New Product Strategies

Although flexibility may be a potential advantage for smaller firms, it is probable that many such firms do not act in a particularly flexible manner. In such firms, flexibility may only be demonstrated in response to an external stimulus. The use of licensing might be one response to an external threat or opportunity impinging upon the firm.

If one objective of policy formulation is to make the firm more robust(1) and to protect it from the vagaries of external forces over which it has no control, then possibly licensing should be considered as one of a number of options in developing new product and market strategies. Licensing may enable the smaller firm to consider products that it would otherwise be unable to exploit, because of their high development costs, and therefore break through some of the marketing and operating thresholds tending to confine it to particular products or markets.(2) Consideration of the licensing 'in' option in a small firm context might increase the options available to the SF both in the development of new products and new markets. However, the management costs of following the licensing option may be high for small firms. (3) In certain instances therefore, the opportunity

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1. Robust here is defined as "the ability to withstand sudden, unexpected change".
2. Hawthorne E.P. 'The Management of Technology', McGraw Hill, 1978
3. In several cases encountered by the author, there appeared to be no 'surplus' management time available to enter lengthy licence negotiations even where such agreements might be 'profitable' in the long term.

cost of utilising such management resources may outweigh the benefits. Where licensing 'out' is considered, however, it might be likened to the sub-contracting of the export function, and hence be viewed as a resource conservation process in some cases. Such a process may enable some small firms to enter markets that they would otherwise be unable to enter using normal 'export' procedures.

It is probably unrealistic to suggest that licensing might be of value to a majority of smaller firms. In many instances such procedures will not be appropriate. However, for certain smaller firms a consideration of licensing might be realistic as part of the development of new product policies, particularly where innovation into new product areas is being suggested. Such consideration might be anticipated to increase the number of alternative strategies available and hence increase the chance that one of those strategies would be successful.

7. Conclusion

Policy formulation may, in practice, be an inappropriate term to describe the process whereby many small firms react to and develop within their environment. While a small minority of such firms may adopt a structured approach, in most instances 'policy' is probably formulated either explicitly or implicitly by no more than one or two individuals on an ad-hoc basis.[1][2] It is suggested that in the latter group of companies, licensing may frequently arise in a reactive manner rather than as part of any strategic planning process.

In conclusion, it has been an objective in this chapter to consider the role of flexibility, comparative advantage and other factors pertaining to small firm operations. It is suggested that licensing may have a role in enhancing such flexibility. However, it is also apparent that there is little data available about small firms' flexibility in practice. The following sub-chapter therefore endeavours to explore whether a sample of small firms did in fact utilise flexible response in their product market policies.

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1. Ray, G.H. op.cit.
2. Hankinson, A. op.cit.

E. A MEASURE OF SMALL FIRM FLEXIBILITY

1. Introduction

The number of available empirical studies into the performance of small firms as distinct from more theoretical papers describing such firms does not appear to be very great. While numerous authors have written about SFs, measurements of their success in specific market sectors are not generally available.[1] A lack of information, therefore, makes it difficult to measure the actual flexibility of small firms in formulating their business policies. It was suggested in the previous section that the potential for small firms to act in a flexible manner by moving in and out of particular products and/or markets might be one of their major strengths. It is therefore a purpose of this section to endeavour to measure whether such flexibility has apparently been utilised in a sample of such firms.

Three separate sectors make up this study as follows: Empirical studies making use of governmental statistical data;[2] Analysis of other published data classifying small firms[3] and industry case studies. The latter study was intended to demonstrate the

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1. CBI - Enterprise into the 80s - op.cit.
   "Apart from the Bolton report there remains relatively little research and information on smaller firms in the UK so that reliable up-to-date statistics are often not available."

2. Census of Production figures for 1976. Department of Industry

3. 'Kompass', Kompass Publishers Ltd, 1981

way in which small firms have been able to compete in specific market sectors, in part by their speed of response and general flexibility.

2. Method

A. Census of Production Analysis

The Department of Trade and Industry Census of Production statistics[1] provide a useful source of data on the employment, output, capital expenditure and total stocks and work in progress attributable to different sizes of firms, broken down by industry. This information can be complemented by data from other sources, notably the survey on Research and Development expenditure classified by industry and published as Business Monitors by the Department of Industry.[2]

It was the objective of this part of the study to carry out three linked analyses of the statistical data. These were as follows:

> Output in an Industry Attributable to Small Firms
>
> Analysis of the Census of Production (COP) figures was made to define in which industries small firms were responsible for a large percentage of the output.

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1. Business Monitor PA 1002, 'Analysis of Establishments by Size of Employment, HMSO, 1981

2. Business Monitor, M014, HMSO 1981

Industries were ranked by the proportion of net output attributable to small firms. The results of this analysis comprise Appendix 2.1

Analysis of Relevant Factors

In conjunction with the industry ranking made above, investigation was made of those factors which might be responsible for, or affect, the proportion of net output attributation to small firms within an industry. Factors considered included Capital expenditure, Research and Development expenditure, and expenditure on Stocks and Work in Progress. These factors were tabulated against the net output data in Appendix 2.1.

The three factors above were then regressed against the net output data using the 'Minitab Package'[1] for regression analysis. Results from this analysis are shown as appendices 2.2A, 2.2B, 2.2C and 2.2D.

Industry by Industry Analysis

Industry by industry analysis was made of the three factors noted above to define percentages attributable to all the size ranges within the industry. Thus the percentage of total industry output (for example) attributable to firms in six size ranges was made. The

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1. Ryan, T A and Joiner, B L (1976) 'Minitab Student Handbook' Duxbury Press (Massachussets)

data for this analysis comprises Appendices 2.3A to 2.3D and the analyses are displayed as histograms in Appendices 2.4A - 2.4R. These cover all manufacturing industries classified under the Standard Industrial Classification.

B. Empirical Small Firms Analysis

Entries in published business directories of companies provide one method of analysing the development of particular companies over time. However, there may be disadvantages in using such data. First, since entry is by subscription, companies make the decision whether or not they wish to have a directory entry and are therefore self-selected. Secondly, publishers of such directories may round statistical data up or down to fit their own classifications and thirdly, the data may not always be presented in a way which allows simple analyses to be carried out. However, directories do provide a large sample of data that has been collected and collated over a period of time.

In the case of this analysis, the Directory 'KOMPASS'[1] was used as a data source to define the numbers of companies moving in and out of particular product markets. A sample of two hundred small and medium sized manufacturing firms[2] was chosen. Numbers

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1. KOMPASS, op.cit.

2. 0-200 employees

of firms were taken from each industry in a ratio corresponding to the importance of that industry in terms of its output as a percentage of total industrial output. A sample of one hundred larger firms[1] was used as a Control/Comparison sample. The product and market classifications made by KOMPASS for the small firm sample were used to denote the number of market groups in which the companies were operating over a ten year period (1971-1981). Analysis was then made of this data to measure the changes in the markets that the firms were operating in. The objective of this study was to measure whether smaller firms were actually operating in a flexible manner by moving into or out of product areas over time.

C. Industry Case Study Analysis

For the purpose of considering the ability of small firms to act flexibly within particular industries, three case studies, of the microcomputer, machine tool and petrol distribution and retailing industries were made. The objectives of choosing these three particular industries were: to choose three very different industries; to identify both traditional successful, traditional declining and 'new' industries; to define industries in which small firms were strongly and poorly represented and to define industries encompassing both manufacturing and distribution

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1. 201+ employees

activities. The objective of the case studies was not to carry out 'in depth' analyses of those industries, but to consider the role of smaller firms within a representative sample of industries.

3. Results, Interpretation

A. Census of Production Analysis

The analyses of the Census of Production figures which comprise appendices to this chapter suggest that smaller firms do have an important role to play in many industries. In some industries they are responsible for a majority of the industry output. The results of the analysis are reported and interpreted below.

Output in an Industry Attributable to Small Firms

The output analysis showed that in four industries, leather, timber, metal goods and clothing, small firms accounted for more than forty per cent of total output. In the case of leather and timber, the proportion was roughly seventy per cent in each case. This suggests that in these industries, small size is not a disadvantage and that smaller firms can compete successfully against larger firms. This may be due to a large number of small market segments in which smaller firms may be able to operate as a result of comparative advantage. An alternative possibility is that smaller firms may have an absolute advantage in offering services that larger firms could not easily provide in such sectors.

Analysis of Relevant Factors

It was suggested above that smaller firms may have a comparative or absolute advantage in those industries where they are responsible for a high percentage of output. Factors that might explain these output levels could include high labour, low capital and research and development intensity. High labour intensity might make it easier for smaller firms to enter and grow within those markets but would also probably reduce any advantage larger firms might have through economies of scale. Conversely, where high research and development expenditures were present as in the case of chemicals and electrical engineering, the percentage of small firms was low. This situation might also be anticipated to apply in those industries where stocks and work in progress expenditures were high, such as the coal and shipbuilding sectors.

The regression analyses of output against research and development expenditure, capital expenditure and costs of stock and work in progress, comprising appendices 2.2A B, C, and D provide only limited support for the proposal above. Results showed little correlation between the amount of output accounted for by small firms on an industry basis and any of the three factors except research and development.

Research and Development expenditure was found to be negatively correlated with the proportion of output accounted for by small firms within each industry. The amount of variability explained by this factor was 36.2 per cent after adjustment for degrees of freedom compared to 13.5 per cent for capital expenditure and 14.0 per cent for stocks and work in progress. This would tend to support the theory that in some industries research 'threshold' barriers do exist which small firms may find difficult to overcome. However, it may be necessary to treat this result with a degree of caution since classification of 'Research and Development' expenditure in smaller firms may be problematical.[1]

It is, perhaps, surprising that capital expenditure is not correlated with the percentage of small firms net output within industries. However, since there may be economies of scale in the purchase of capital equipment tending to favour larger firms requiring particularly expensive capital equipment, this result may not be unreasonable. It is suggested therefore that the figures

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1. See for example, Wyatt, S. op.cit.

   Wyatt suggested that "Another explanation (of small firms' apparently higher proportion of innovations than larger firms) .... is that there is a lower degree of functional specialisation in small firms, so that a higher proportion of innovative activities occur outside what is defined as R & D activities". If some R & D in small firms does go unrecorded this would tend to make R & D expenditure appear proportionately more important in larger firms.

for capital investment should also be treated with some caution. The 'capital' equipment purchased by smaller firms may not always be comparable with that purchased by larger firms.

Two industries stand out as having high expenditures on stocks and work in progress (more than one hundred per cent of net output annually). These are the coal and shipbuilding industries and in these industries small firms clearly have little part to play except as sub-contractors to larger concerns. Indeed it seems likely that the 9.5% and 14.6% of net output attributable to small companies in these industries respectively, can be mainly attributed to sub-contracting in each case. If these industries are excluded however, the variability between smaller and larger concerns becomes less apparent, while the regression analyses indicate that such expenditures on these factors do not provide a barrier to small firms' operation in those markets.

Industry by Industry Analysis

The second major analysis was of various factors against six employment size bands within industries. No data was available on an employment size basis for research and development expenditures but percentage employment, net output, stocks and work in progress and capital expenditure per head were plotted for all sixteen Standard Industrial Classifications. The results of this analysis are plotted as histograms in Appendices 2.4A - 2.4R.

The results showed no clear correlation between capital expenditures and the size of firms within industries. Indeed in several industries, notably food, drink and tobacco and chemicals, smaller firms appeared to be more capital intensive than larger firms. This is interesting in suggesting that capital expenditures may not be a barrier to the entry of smaller firms in these industries. Conversely however, high capital expenditures in smaller firms might be viewed as a necessary means for them to compete successfully with larger concerns in these industries.

Work in progress and stocks in larger companies were higher for nearly all industries. However there were important exceptions to this, notably bricks, pottery and glass and coal and petroleum. In several industries the largest companies appeared to carry substantially less stocks and work in progress than medium and medium/large companies. This case was seen in all industries except leather, mechanical engineering, textiles, chemicals, metal manufacture, shipbuilding and vehicles and suggests that the largest companies handle their stock and work in progress more efficiently than the medium sized firms. It would be possible to postulate that the smallest firms have to be efficient users of stock to survive while the largest firms have shareholders seeking profitability, and hence manage their operations with the objective of being efficient.

The medium and large/medium sized firms might be less open either to cost pressures or outside influences. This postulation would tend to conform to the views of Sargant Florence[1] noted above, on the efficiency of medium sized, family owned firms.

In the case of employment, low capital intensive industries had a high proportion of personnel in smaller firms, as might be anticipated. Thus in the leather goods and timber and furniture industries, more than fifty per cent of personnel were employed in firms with less than one hundred people. Conversely, in the highly capital intensive industries of vehicle manufacture, and shipbuilding, the very large firms accounted for a majority of employment. This might be anticipated. However, it is interesting to note that in several industries very small, medium and very large companies appeared to be over-represented, while small/medium and medium/large companies were under-represented in employment terms. This might suggest that in many industries the very small firms were able to fill tiny market niches, though unable to develop through small to medium size, while medium/large companies were effective targets for takeover by very large companies, thus removing them as independent concerns. This postulation clearly has to be highly tentative at this

1. Sargent Florence, op.cit.

stage however, but the data does suggest that further work in this area could be valuable.

The figures for output followed those for employment to a great extent. However it was interesting to note that in many industries the industry percentage employed divided by the percentage of output at that size range changed from a negative to a positive figure as size of firm increased. In mechanical engineering, for example, very small firms (1-99 employees) accounted for 24.4% of employment and 20.8% output, while very large firms accounted for 25% employment and 25.6% net output. Clearly scale economies may have an influence upon these figures, but it may be relevant to note those industries where smaller firms appeared more efficient (i.e. more percentage output than employment) such as bricks, pottery, glass and food.

B. Small Firms Analysis

The small firms analysis utilising published information(1) on small firms (directory entries) was designed to measure the movement by small firms in and out of product markets. A ten year period was chosen as the basis for a sample of 200 small firms

1. Kompass, op.cit.

and 100 larger firms. Product groups in which the firms were operating at the beginning and end of this period were noted and analysed. 'Movement' was defined as a firm either entering or leaving a product market as defined in the directory. The results of that analysis are tabulated below.

TABLE 2.1

Small Firms Product Change Over Ten Years

	Small firms		Large firms	
	Numbers	%	Numbers	%
Original sample (1971)	200	-	100	-
Sample after 10 years (1981)	101	50	57	57
Dropped out (a)	99	50	43	43
Change in product groups (b)	43	43	18	31

(a) No longer listed

(b) Increase, decrease, or change, in product groups

In the product group analysis, small firms had changed groups substantially more than the larger concerns. With caution it is possible to say that these movements do demonstrate a greater mobility by some small companies in moving from product to product and market to market than their larger counterparts. However, the change in number of firms that were no longer listed in KOMPASS was also greater for the smaller than the larger firms. This would suggest that larger firms may be more 'stable' than smaller firms.

The results of the small firms analysis are probably not conclusive in demonstrating greater flexibility among small than large firms. However, the figures do suggest that many smaller firms do move into or out of particular product areas over time.

4. Industry Case Studies

In the sectors above, the suggestion was put forward that SFs might potentially be able to act in a flexible manner. Statistical data was presented to reinforce this suggestion.[1] Such evidence however, may be at best confirmatory and at worst misleading. In specific industries, however, small firms have undoubtedly played an unequivocally important role. For the purpose of this thesis, the microcomputer, machine tool and petrol retailing industries are considered to demonstrate the role of small firms in very different product markets. It is not an objective to make in-depth analyses of those industries however.

1. Necessarily aggregated into industry groups which may, in some cases, obscure the role that small firms play in smaller market segments.

A. The Microcomputer Industry

The microcomputer industry is one of the fastest growing young industries in the world.[1] From a standing start in 1977 it has developed to an annual turnover figure of several billion dollars. While large corporations, particularly IBM, have historically dominated the computer industry, in microcomputers it was initially the small firms who responded to a need, created, developed and supplied the market. Today, while many small companies still operate in the microcomputer field, large concerns[2] dominate the industry.

The fundamental development leading to the formation of the industry was the development of the microprocessor in the mid 1970s. In this development SFs played a relatively minor role. In the application of the microprocessor, its incorporation in consumer and industrial products however, small companies took a lead. The development of so called 'personal' computers[3] led to the development of small business systems, continually increasing in power and sophistication and decreasing in price. Most of the larger companies did not, in the first years of the process enter the market at all.[4] This decision may have been

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1. Financial Times Report, 21 August 1981
2. Although in the case of (for example) Apple Computer, this was a small company which has now grown to be large
3. This term first appeared in 1975/76
4. Financial Times Report, 18 January 1982

due to a consideration that the 'hobbyist' market would not be a big enough segment for them to operate in at a profit. The smaller firms had also begun to pioneer new methods of marketing computers in which most of the larger firms were unversed.(1) However, as the industry grew in size, larger firms began to consider entry.

In 1981 several of the larger, mainframe computer manufacturers entered the market, in some cases licensing microcomputer designs in from smaller firms.(2) This market entry was compounded by an increasing number of smaller concerns also entering the market. While many of the smaller concerns endeavoured to exploit small market niches, others aimed at producing general purpose machines, with the result that by 1983 technological excellence was being compounded as an arbiter of success by marketing skills and the availability of resources to enable long term price wars to be successfully fought. This led to the demise or takeover of many of the smaller companies. Several of the larger companies were also forced to abandon the market with heavy losses. By the middle of 1984, International Business Machines (IBM) had established itself as market leader with many of the small and medium sized firms struggling to compete.

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1. Microcomputers were often sold through retail outlets. Also, 'packaged software', applicable to many customers began to play an increasingly important role.

2. Financial Times, 15 September 1981, 'ICL to broaden product range'. ICL set up several licensing agreements, notably with Three Rivers Ltd in the US and Fujitsu in Japan.

Industry analysts suggested that IBMs success stemmed mainly from its ability to guarantee long term service for its products rather than from technological or cost criteria.

The microcomputer industry attracted many small entrants before attracting larger concerns, when the size of the market had been established. In the early stages of the industry's development larger firms could have entered the market but chose not to do so, probably because they perceived that the size of the market was too small. This allowed smaller firms to dominate initially. As the structure of the industry became clearer, notably in relation to the methods by which microcomputers were marketed and as the market grew in size, the larger companies entered, driving many of the smaller firms out.

The history of the microcomputer market probably follows a classic pattern for the development of new industries. Early development by smaller firms but eventual domination by larger concerns. Smaller firms do still appear to have a role within the microcomputer industry however, in filling small, specialised market niches, and in providing supporting services to the larger firms.[1]

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1. See for example, Cave, A. 'Banking and Finance'. Financial Times 23 April 1985. "Faced with IBMs mounting dominance of the business personal computer market, other manufacturers have sought out niches where they hoped to survive with little or no competition".

B. The Petrol Retailing Industry

The petrol distribution and retailing market has become increasingly competitive since the 1960s.[1] The industry is dominated by large, vertically integrated companies and might, therefore, not appear to be a market in which smaller firms would usually be able to compete successfully. However, during the 1960s and the early 1970s, the market was the subject of substantial structural change. This change was catalysed by the entry of new companies into the market. While many of these companies were subsidiaries of already existing large international oil companies, a proportion comprised small, independent new entrants to the industry. Several of the independents were diversifying from other retailing activities. Over a ten year period[2] the independents increased their market share from less than two per cent to more than five per cent. A response from the larger oil companies to this increase was to endeavour to 'buy-out' the independents and as a result of such takeovers, the market share of the independents did fall back in 1973. However, during the 1970s as feedstock prices increased and supplies became less secure, smaller companies regained and surpassed their previous market share[3] taking advantage of the extreme

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1. 'Petrol Prices on the Slide' Sunday Times, 17 January 1982
2. Lowe, J.F. 'Competition in the UK Retail Petrol Market 1960-1973. Journal of Industrial Economics, March 1976
3. 'Fewer Petrol Stations but Smaller Companies Benefit' Financial Times, 2 March 1982

price sensitivity of the market by purchasing petrol at its cheapest supply point.

The success of the independent companies demonstrated that smaller concerns can compete with larger concerns in certain market places. The larger firms were probably restricted in their ability to compete on price terms with smaller firms, because of their vertically integrated high capital investment structure, leading to a requirement for a minimum return to cover such investment.[1] A surplus of cheap, refined gasoline from sources outside the UK market place provided a supply source for smaller firms to exploit.

Although the petrol retailing industry, based upon service rather than manufacturing skills probably utilises little technology licensing, the purpose of this study was to demonstrate that smaller firms can compete successfully with larger firms in some cases by operating flexibly and quickly to take advantage of opportunities in the market place. In this market smaller firms have exploited an absolute advantage - cheaper sources of petrol supply, to compete with larger firms.

---

1. Sunday Times 14 March 1982.
   'Battling well on an Oily Wicket'
   "Smaller companies .... have smaller overheads and are able to make money while the majors, saddled with refining costs are making losses."

C. The Machine Tool Industry

The Machine Tool Industry provides an interesting example of a market where small firms may have exploited a comparative advantage in competing with larger concerns. The industry is probably not one which is particularly suited to mass production techniques[(1)] even for 'standard' machine tools. Many of its member companies are therefore small, exploiting small market segments[(2)]. It is an industry in which there appears to be an increasing amount of technical change.[(1)]

The machine tools industry probably provides a relatively accurate barometer of world manufacturing trends since it occupies a 'core' area of most manufacturing activity. The industry appears to be characterised however, by a highly cyclical demand for its products. In such conditions small firms might be anticipated to be disadvantaged through resource constraints preventing quick expansions of capacity in times of high demand while also lacking the ability to underwrite losses during low demand cycles. Stockpiling of finished products to take account of such cyclical market movements might also be unattractive to smaller firms for the same reason. However, smaller firms appear to have overcome such problems, and maintain a major role within the industry.[(3)]

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1. Financial Times Survey 23 April 1980
2. Census of Production Figures - Business Monitor 1980 'Metal Working Machine Tools' HMSO
3. Business Monitor 1980 - Department of Trade and Industry In 1978 small companies (0-200 employees) were estimated to account for 36% of net output in the industry. Firms smaller than 300 employees were responsible for nearly 50% of industry output. HMSO

While the cyclical nature of the industry and the way it is structured may have disadvantaged small firms in some cases, flexibility may have been a major factor in their favour.[1] Specialisation by small firms in very small market sectors and the specialisation of groups of companies in larger sectors may have led to the concentration of production of particular machine types in particular countries.[1] In the newer machine tool markets such as robotics, a continuing requirement for close collaboration between manufacturer and buyer may have reduced scale economies to some extent. This might be responsible for the large number of licensing agreements in this field as robot manufacturers seek local partners to provide high levels of service in their own markets.

The machine tool market is considered to demonstrate how smaller firms can operate successfully in market segments characterised by a high requirement for service backup. In such segments a degree of flexibility may be required to take advantage of new opportunities within the market.

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1. Financial Times 'Report on the Machine Tool Industry' 23 April 1980.
"Small companies ..... have retained a degree of flexibility which has been proved very necessary during periods of highly cyclical demand."

F. CONCLUSIONS

It has been a major objective in this chapter to define and describe the environment in which small firms operate, and to explore some of the factors impinging upon the development of policy making processes in such firms. It seems probable that many smaller firms do not approach policy formulation in a particularly proactive manner, but may develop through more reactive strategies in which the potential to act quickly in a flexible manner may be important.

However, it seems likely that although, potentially, smaller firms can act very flexibly, to take advantage of market opportunities, a majority probably do not usually act in this manner unless prompted to do so by outside stimuli powerful enough to initiate such developments. It seems clear that a large number of smaller firms are content to exploit small market segments with low potential for development. Such strategies may lead to over dependence on small numbers of product lines, vulnerable to external developments in technology, marketing techniques or competition. Diversification away from such dependence may, however, also carry its own risks. In conditions of increasing competition, some smaller firms may be forced to consider such diversification however. A consideration of some of the practical aspects of this process in smaller firms comprises part of the following chapter.

Lastly, it was suggested that consideration of the Boston

Consulting Group model for product analysis could be useful in an exploration of the potential for utilising technology licensing in the exploitation and development of the product portfolio in some smaller firms. However, identifying products suitable for exploitation by smaller firms could be problematical in some cases.

While some smaller firms probably have an absolute advantage over larger firms in the provision of service intensive 'products' most such firms probably develop strategies to exploit a comparative advantage in small market segments. In this process the use of technology licensing may be valuable in some instances. Further exploration of this factor is made in depth, in Chapter 6.

APPENDICES TO CHAPTER 2

APPENDIX 2.1

EXPENDITURE ON CAPITAL, RESEARCH AND DEVELOPMENT AND

STOCKS/WORK IN PROGRESS AS A PERCENTAGE

OF OUTPUT ATTRIBUTABLE TO SMALL FIRMS

INDUSTRY	NET OUTPUT SMALL FIRMS AS % TOTAL	CAPITAL EXPENDITURE % NET OUTPUT	R & D EXPENDITURE % NET OUTPUT	STOCKS/WIP EXPENDITURE % NET OUTPUT
LEATHER	72.2	5.70	0.08	65.58
TIMBER	67.7	5.77	0.04	45.9
METAL GOODS	44.7	6.26	0.59	47.53
CLOTHING	43.7	3.08	0.08	40.65
BRICKS	36.3	8.22	0.77	28.08
PAPER	34.2	5.96	0.27	28.18
OTHER MANUF	32.6	7.10	1.52	36.08
INSTRUMENTS	32.4	5.65	2.50	58.95
MECH.ENG	30.7	6.16	1.57	64.84
TEXTILES	30.6	7.46	0.92	53.88
FOOD	24.0	8.39	1.10	47.69
CHEMICALS	16.9	15.60	6.78	48.88
METAL MANUF	16.2	23.12	1.20	74.10
SHIPS	14.6	8.72	1.11	168.19
ELEC.ENG	12.7	6.17	7.01	57.43
COAL	9.5	9.98	5.23	134.72
VEHICLES	7.5	6.93	2.94	79.82

Data from 1976 Census of Production, Business Monitor PA 1002
HMSO 1980

APPENDIX 2.2A

NET OUTPUT IN SMALL FIRMS: CAPITAL EXPENDITURE

```
    nobrief
 -- regr c1 1 c2
```

the regression equation is
y = 45.3 - 1.74 x1

	column	coefficient	st. dev. of coef.	t-ratio = coef/s.d.
	--	45.303	8.730	5.19
x1	c2	-1.7369	0.9282	-1.87

the st. dev. of y about regression line is
s = 17.28
with (17- 2) = 15 degrees of freedom

r-squared = 18.9 percent
r-squared = 13.5 percent, adjusted for d.f.

analysis of variance

due to	df	ss	ms=ss/df
regression	1	1045.1	1045.1
residual	15	4476.5	298.4
total	16	5521.6	

row	x1 c2	y c1	pred. y value	st.dev. pred. y	residual	st.res.
1	5.7	72.20	35.40	4.81	36.80	2.22r
2	5.8	67.70	35.28	4.78	32.42	1.95
3	6.3	44.70	34.43	4.58	10.27	0.62
4	3.1	43.70	39.95	6.37	3.75	0.23
5	8.2	36.30	31.03	4.19	5.27	0.31
6	6.0	34.20	34.95	4.70	-0.75	-0.05
7	7.1	32.60	32.97	4.32	-0.37	-0.02
8	5.6	32.40	35.49	4.84	-3.09	-0.19
9	6.2	30.70	34.60	4.62	-3.90	-0.23
10	7.5	30.60	32.35	4.25	-1.75	-0.10
11	8.4	24.00	30.73	4.19	-6.73	-0.40
12	15.6	16.90	18.21	8.00	-1.31	-0.09
13	23.1	16.20	5.13	14.43	11.07	1.17 x
14	8.7	14.60	30.16	4.21	-15.56	-0.93
15	6.2	12.70	34.59	4.61	-21.89	-1.31
16	10.0	9.50	27.97	4.49	-18.47	-1.11
17	6.9	7.50	33.27	4.37	-25.77	-1.54

r denotes an obs. with a large st. res.
x denotes an obs. whose x value gives it large influence.

APPENDIX 2.2B

NET OUTPUT IN SMALL FIRMS: R & D EXPENDITURE

```
    nobrief
 -- regr c1 1 c3
```

the regression equation is
y = 41.3 - 5.23 x1

	column	coefficient	st. dev. of coef.	t-ratio = coef/s.d.
	--	41.350	4.861	8.51
x1	c3	-5.234	1.648	-3.18

the st. dev. of y about regression line is
s = 14.84
with (17- 2) = 15 degrees of freedom

r-squared = 40.2 percent
r-squared = 36.2 percent, adjusted for d.f.

analysis of variance

due to	df	ss	ms=ss/df
regression	1	2220.3	2220.3
residual	15	3301.3	220.1
total	16	5521.6	

row	x1 c3	y c1	pred. y value	st.dev. pred. y	residual	st.res.
1	0.08	72.20	40.93	4.77	31.27	2.23r
2	0.04	67.70	41.14	4.82	26.56	1.89
3	0.59	44.70	38.26	4.27	6.44	0.45
4	0.08	43.70	40.93	4.77	2.77	0.20
5	0.77	36.30	37.32	4.12	-1.02	-0.07
6	0.27	34.20	39.94	4.57	-5.74	-0.41
7	1.52	32.60	33.39	3.68	-0.79	-0.06
8	2.50	32.40	28.26	3.70	4.14	0.29
9	1.57	30.70	33.13	3.66	-2.43	-0.17
10	0.92	30.60	36.53	4.00	-5.93	-0.42
11	1.10	24.00	35.59	3.88	-11.59	-0.81
12	6.78	16.90	5.86	8.69	11.04	0.92 x
13	1.20	16.20	35.07	3.82	-18.87	-1.32
14	1.11	14.60	35.54	3.88	-20.94	-1.46
15	7.01	12.70	4.66	9.03	8.04	0.68 x
16	5.23	9.50	13.97	6.45	-4.47	-0.33
17	2.94	7.50	25.96	3.93	-18.46	-1.29

r denotes an obs. with a large st. res.
x denotes an obs. whose x value gives it large influence.

APPENDIX 2.2C

NET OUTPUT IN SMALL FIRMS: STOCKS & WORK IN PROGRESS

```
    nobrief
 -- regr c1 1 c4

the regression equation is
y =    45.1 - 0.223 x1

                                           st. dev.    t-ratio =
       column      coefficient             of coef.    coef/s.d.
       --               45.123              8.585          5.26
x1     c4              -0.2228             0.1181         -1.89

the st. dev. of y about regression line is
s = 17.25
with (  17- 2) =  15 degrees of freedom

r-squared = 19.2 percent
r-squared = 13.8 percent, adjusted for d.f.

analysis of variance

 due to      df          ss      ms=ss/df
regression    1      1059.9        1059.9
residual     15      4461.7         297.4
total        16      5521.6

          x1          y     pred. y    st.dev.
row       c4         c1       value    pred. y    residual      st.res.
  1       66      72.20       30.51       4.19       41.69        2.49r
  2       46      67.70       34.89       4.67       32.81        1.98
  3       48      44.70       34.53       4.59       10.17        0.61
  4       41      43.70       36.06       4.98        7.64        0.46
  5       28      36.30       38.87       5.91       -2.57       -0.16
  6       28      34.20       38.84       5.91       -4.64       -0.29
  7       36      32.60       37.08       5.29       -4.48       -0.27
  8       59      32.40       31.99       4.22        0.41        0.02
  9       65      30.70       30.67       4.19        0.03        0.00
 10       54      30.60       33.12       4.33       -2.52       -0.15
 11       48      24.00       34.50       4.58      -10.50       -0.63
 12       49      16.90       34.23       4.53      -17.33       -1.04
 13       74      16.20       28.61       4.37      -12.41       -0.74
 14      168      14.60        7.64      13.05        6.96        0.62 x
 15       57      12.70       32.32       4.24      -19.62       -1.17
 16      135       9.50       15.10       9.39       -5.60       -0.39 x
 17       79       7.50       27.54       4.56      -20.04       -1.20

r denotes an obs. with a large st. res.
x denotes an obs. whose x value gives it large influence.
```

APPENDIX 2.2D

NET OUTPUT IN SMALL FIRMS

(Capital Expenditure, R & D Expenditure, Stocks & Work in Progress)

```
    nobrief
 -- regr c1 3 c2 c3 c4
```

the regression equation is

y = 56.5 - 0.982 x1 - 4.21 x2
    - 0.143 x3

	column	coefficient	st. dev. of coef.	t-ratio = coef/s.d.
	--	56.519	8.529	6.63
x1	c2	-0.9815	0.7754	-1.27
x2	c3	-4.206	1.609	-2.61
x3	c4	-0.14342	0.09752	-1.47

the st. dev. of y about regression line is

s = 13.77

with (17- 4) = 13 degrees of freedom

r-squared = 55.4 percent

r-squared = 45.1 percent, adjusted for d.f.

analysis of variance

due to	df	ss	ms=ss/df
regression	3	3056.9	1019.0
residual	13	2464.7	189.6
total	16	5521.6	

further analysis of variance

ss explained by each variable when entered in the order given

due to	df	ss
regression	3	3056.9
c2	1	1045.1
c3	1	1601.7
c4	1	410.1

row	x1 c2	y c1	pred. y value	st.dev. pred. y	residual	st.res.
1	5.7	72.20	41.18	4.69	31.02	2.40r
2	5.8	67.70	44.10	4.69	23.60	1.82
3	6.3	44.70	41.08	4.18	3.62	0.28
4	3.1	43.70	47.33	5.56	-3.63	-0.29
5	8.2	36.30	41.18	4.96	-4.88	-0.38
6	6.0	34.20	45.49	5.14	-11.29	-0.88
7	7.1	32.60	37.98	4.24	-5.38	-0.41
8	5.6	32.40	32.00	4.09	0.40	0.03
9	6.2	30.70	34.57	3.72	-3.87	-0.29
10	7.5	30.60	37.60	3.76	-7.00	-0.53
11	8.4	24.00	36.82	3.86	-12.82	-0.97
12	15.6	16.90	5.68	9.54	11.22	1.13 x
13	23.1	16.20	18.14	12.27	-1.94	-0.31 x
14	8.7	14.60	19.17	11.02	-4.57	-0.55 x
15	6.2	12.70	12.74	9.32	-0.04	-0.00
16	10.0	9.50	5.40	8.38	4.10	0.37
17	6.9	7.50	26.03	4.15	-18.53	-1.41

r denotes an obs. with a large st. res.

x denotes an obs. whose x value gives it large influence.

APPENDIX 2.3A

Industry	Capital expenditure per head (£s') by firm size					
	1-99 Employees	100-199	200-499	500-999	1K-1½K	1½K+
Leather Goods	230	325	237		← 316 →	
Timber/Furniture	319	311	326	356	232	100
Metal Goods	328	321	356	311	332	314
Clothing Footwear	87	85	99	102	100	88
Bricks, Pottery, Glass	660	547	545	721	522	488
Paper, Printing, Publishing	356	429	375	378	597	328
Instrument Engineering	224	283	246	265	414	324
Mechanical Engineering	346	338	372	345	409	392
Textiles	319	348	302	346	300	395
Food, Drink, Tobacco	743	768	636	560	599	624
Chemicals and Allied	826	2960	1242	1244	850	2228
Metal Manufacture	543	683	782	454	642	2299
Shipbuilding	240	234	140	173	267	456
Electrical Engineering	327	351	329	358	349	344
Coal and Petrol	1750	1250	1744	3790	← 2951 →	
Vehicles	313	354	374	286	378	396

Source - Census Returns 1976

APPENDIX 2.3B

Industry	Stocks and WIP per head £s by firm size					
	1-99 Employees	100-199	200-499	500-999	1K-1½K	1½K+
Leather Goods	2609	2750	3550	←4158→		
Timber/Furniture	2211	2630	2730	2845	4434	2687
Metal Goods	1807	2295	2512	3132	3836	3371
Clothing/Footwear	925	1090	1300	1465	1680	1504
Bricks, Pottery, Glass	1726	1753	2240	2236	1996	1982
Paper, Printing Publishing	1322	1811	2074	2230	2450	1747
Instrument Engineering	1946	2797	2914	2782	4514	3506
Mechanical Engineering	2153	3108	3758	4220	4188	5513
Textiles	1963	2249	2397	2604	2403	2901
Food, Drink, Tobacco	2336	2993	2794	3691	5616	4262
Chemicals and Allied	4158	4788	5295	5494	4283	5856
Metal Manufacture	2567	3000	3432	4750	5308	5463
Shipbuilding	1781	2654	3672	3580	6870	9129
Electrical Engineering	2076	2402	2808	3313	4026	3429
Coal and Petrol	14000	25750	45888	26420	←37638→	
Vehicles	2215	2366	2932	3069	3378	4944

Source - Census Returns 1976

APPENDIX 2.3C

Industry	Employment - % employment by size					
	1-99 Employees	100-199	200-499	500-999	1K-1½K	1½K+
Leather Goods	57.6	18.9	18.9	← 4.5 →		
Timber/Furniture	52.2	17.8	16.3	8.1	2.5	2.9
Metal Goods	38.1	12.6	17.2	14.7	7.6	9.6
Clothing/Footwear	31.8	14.8	22.9	14.0	5.3	11.0
Bricks, Pottery, Glass	21.5	11.2	17.7	16.6	9.8	23.5
Paper, Printing, Publishing	29.3	11.8	22.8	12.9	6.5	16.6
Instrument Engineering	21.7	11.0	17.4	19.0	10.9	19.6
Mechanical Engineering	24.4	10.2	16.5	16.0	7.4	25.0
Textiles	17.9	14.4	22.6	14.1	8.9	22.0
Food, Drink, Tobacco	14.3	8.0	17.0	15.7	7.9	36.8
Chemicals and Allied	10.9	6.9	15.2	14.8	10.0	42.2
Metal Manufacture	11.4	7.0	14.4	11.0	8.2	47.8
Shipbuilding	10.2	4.6	6.0	8.4	7.3	63.4
Electrical Engineering	9.4	5.0	12.6	14.3	6.4	52.2
Coal and Petrol	10.2	5.7	25.6	17.6	← 40.0 →	
Vehicles	5.4	3.4	6.1	5.4	5.7	73.9

Source - Census Returns 1976

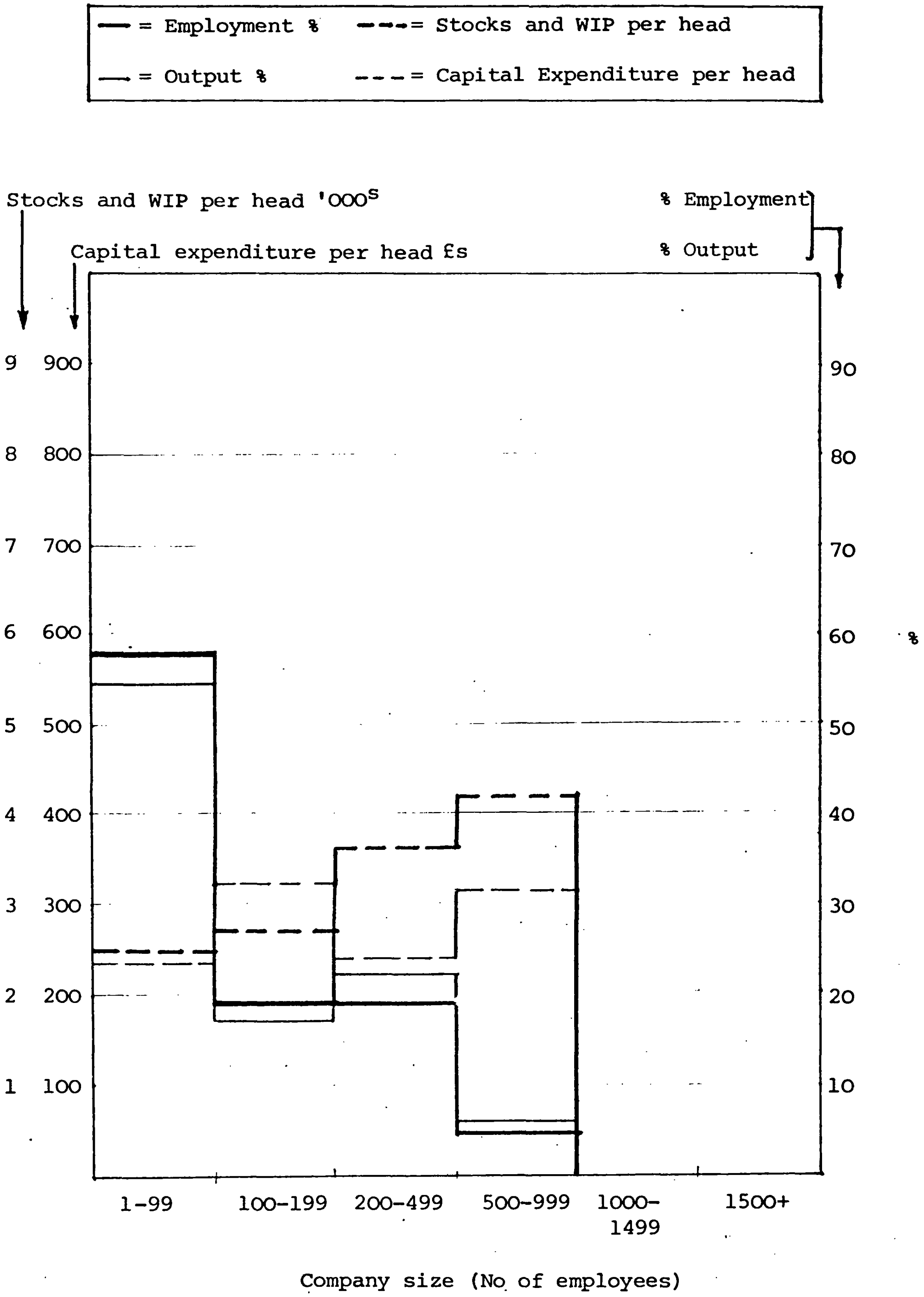
APPENDIX 2.3D

Industry	Net output by firm size					
	1-99 Employees	100-199	200-499	500-499	1K-1½K	1½K+
Leather Goods	54.7	17.5	22.0	←	5.7	→
Timber/Furniture	49.7	18.0	17.3	8.8	3.2	2.9
Metal Goods	32.3	12.4	17.0	17.8	10.2	10.2
Clothing/Footwear	29.5	14.2	23.5	14.3	6.0	12.4
Bricks, Pottery, Glass	23.5	12.8	18.5	15.0	7.7	22.5
Paper, Printing Publishing	23.4	10.8	24.4	13.8	8.1	19.5
Instrument Engineering	20.1	12.3	16.5	18.3	14.6	18.0
Mechanical Engineering	20.8	9.9	17.4	17.8	8.3	25.6
Textiles	16.6	14.0	21.9	14.3	8.6	24.6
Food, Drink, Tobacco	15.1	8.9	16.0	13.8	7.6	38.8
Chemicals and Allied	10.0	6.9	16.7	14.0	7.0	45.0
Metal Manufacture	9.4	6.8	13.3	11.3	12.5	46.7
Shipbuilding	9.7	4.9	6.7	7.7	8.3	62.4
Electrical Engineering	8.0	4.7	12.4	14.8	8.0	52.1
Coal and Petrol	4.3	5.2	27.7	12.6	←50.4	→
Vehicles	4.6	2.9	5.5	5.2	5.3	76.5

Source - Census Returns 1976

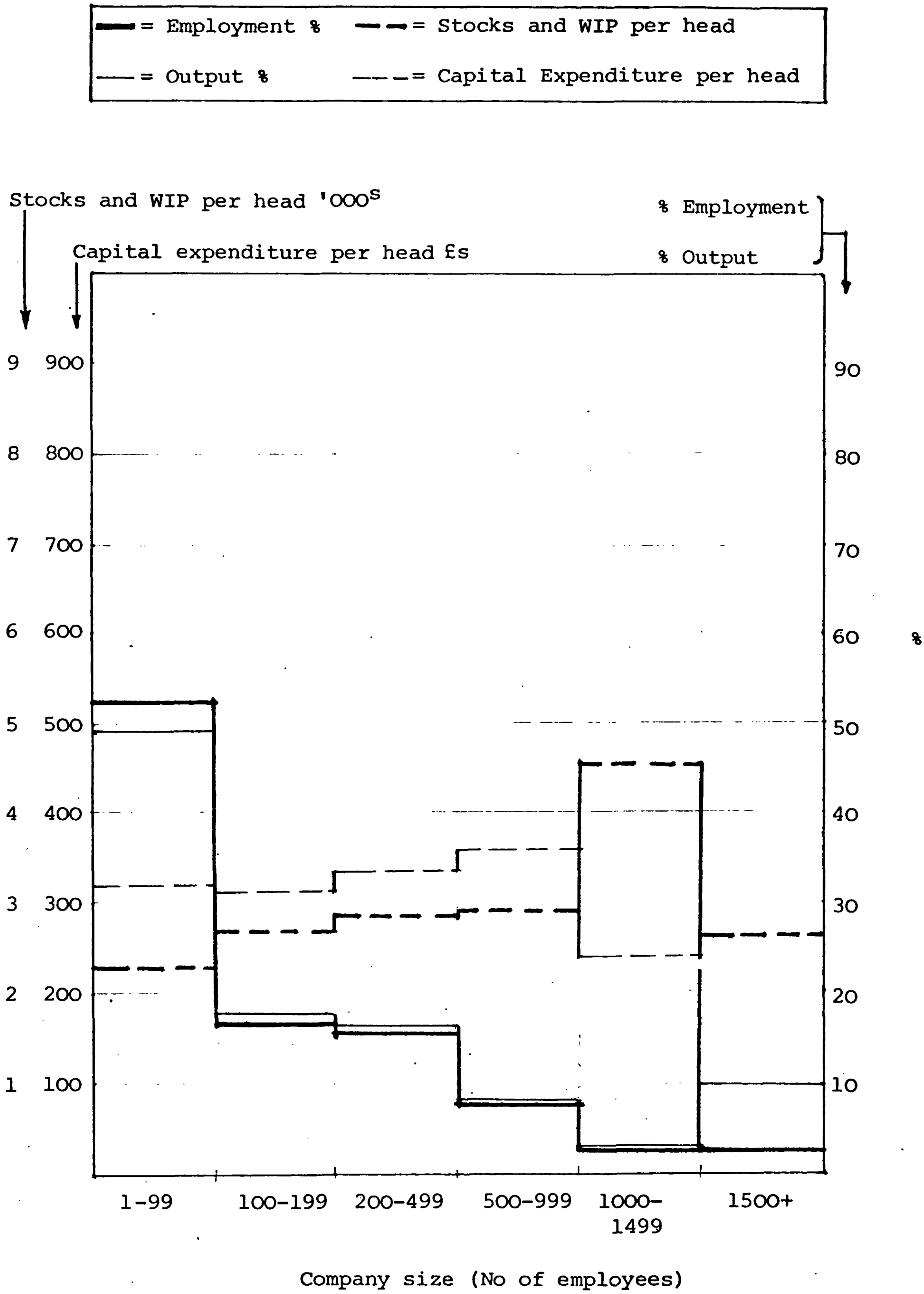
APPENDIX 2.4A

LEATHER GOODS



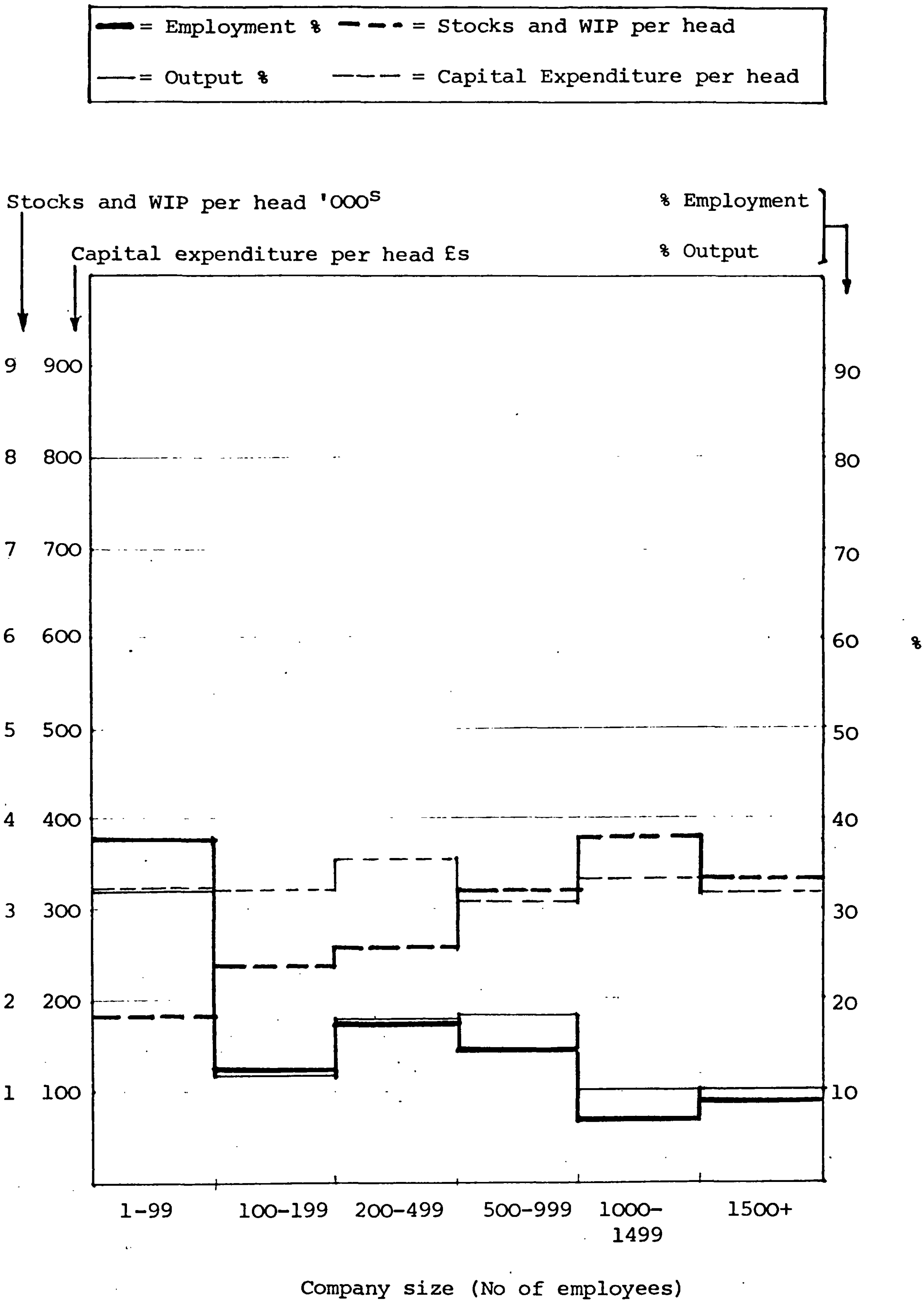
APPENDIX 2.4B

TIMBER AND FURNITURE



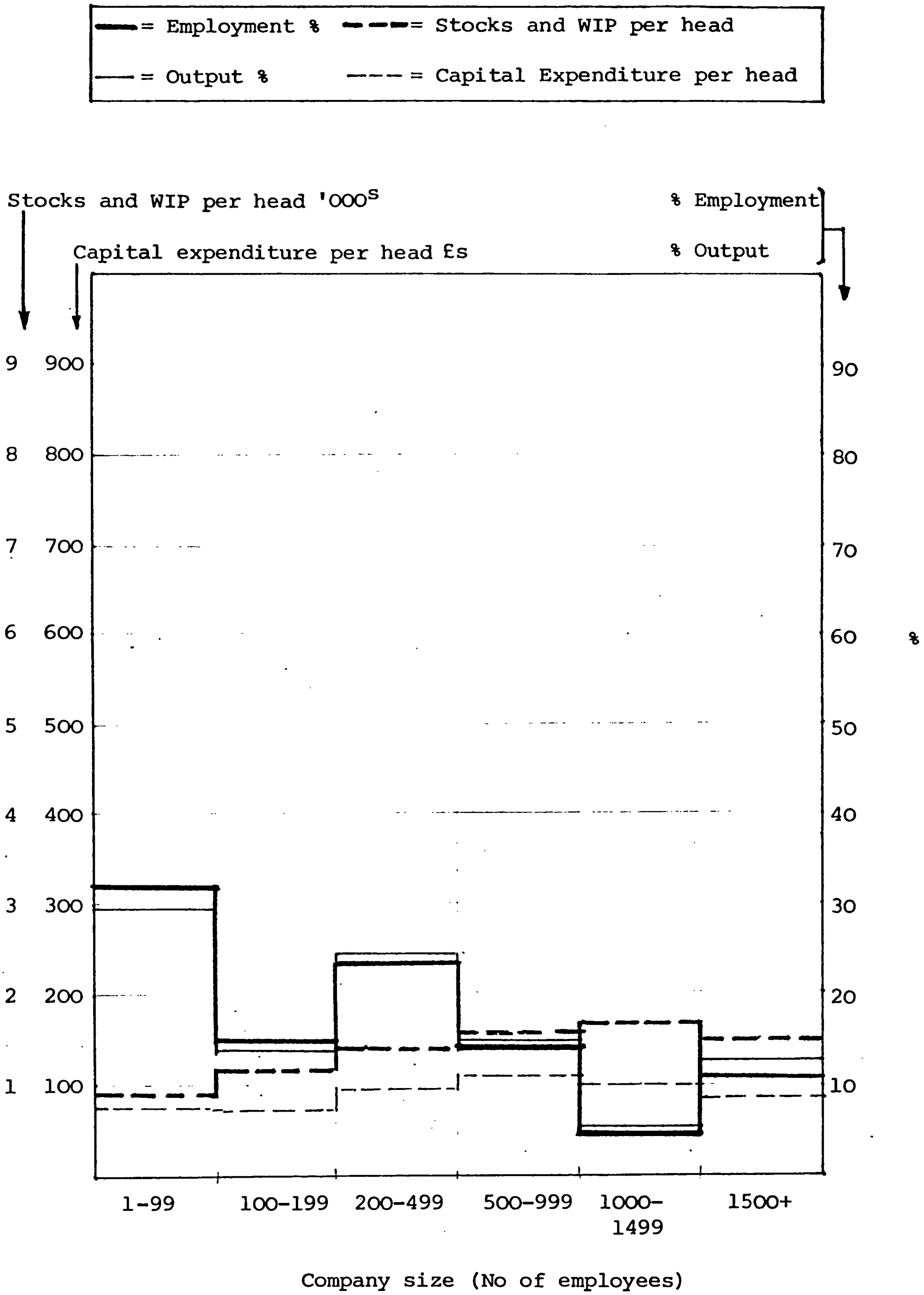
APPENDIX 2.4C

METAL GOODS



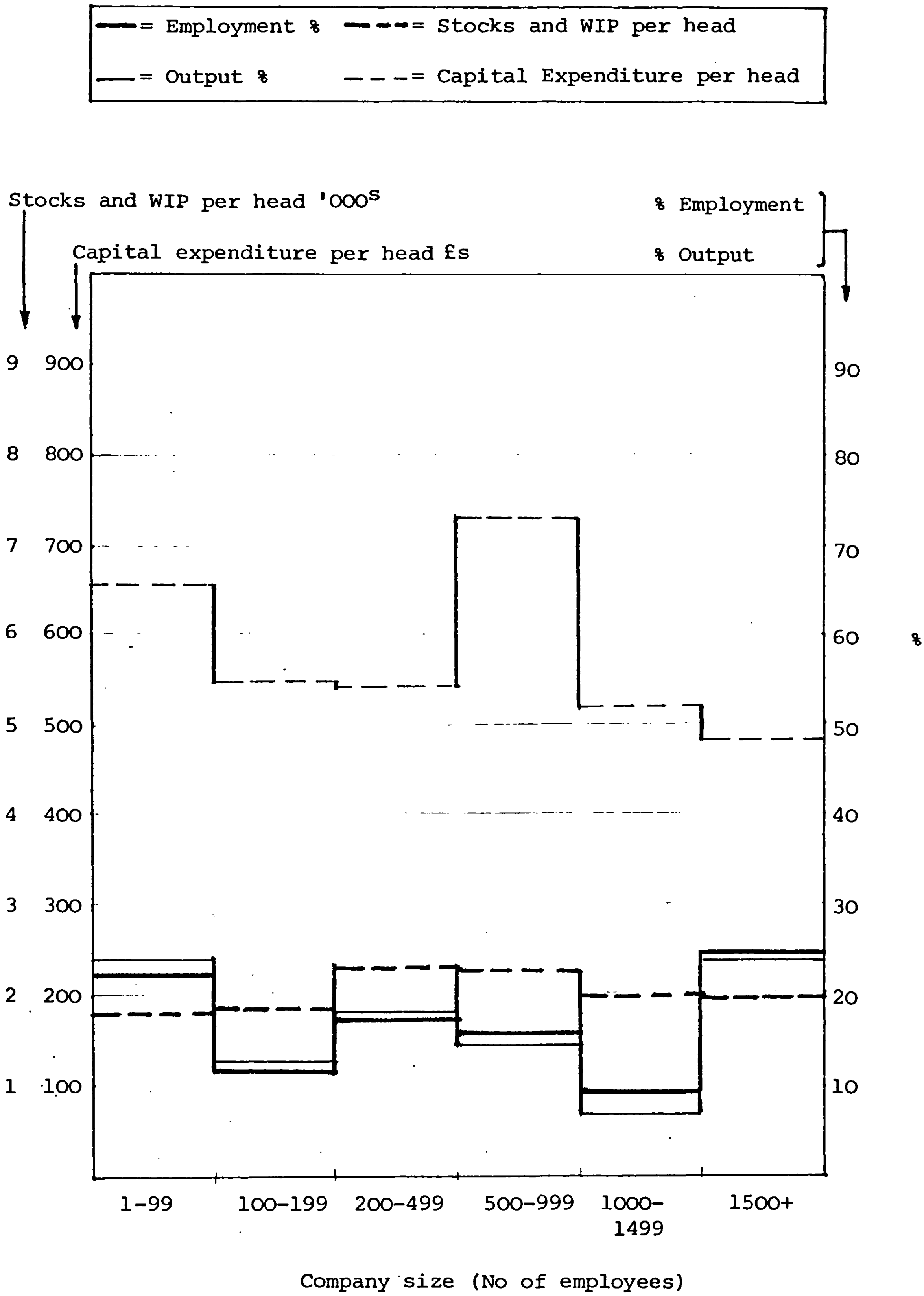
APPENDIX 2.4D

CLOTHING AND FOOTWEAR



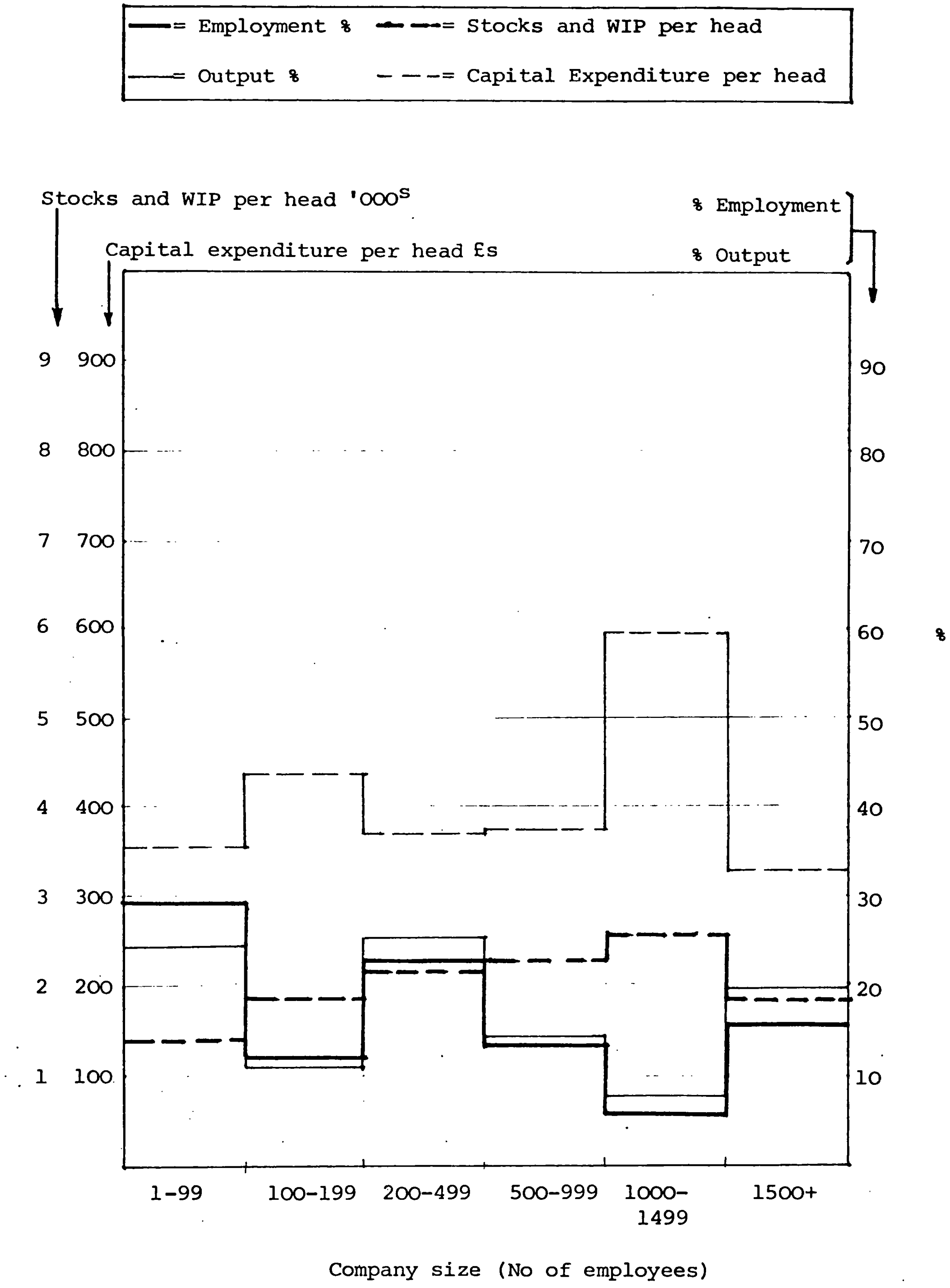
APPENDIX 2.4E

BRICKS/POTTERY/GLASS



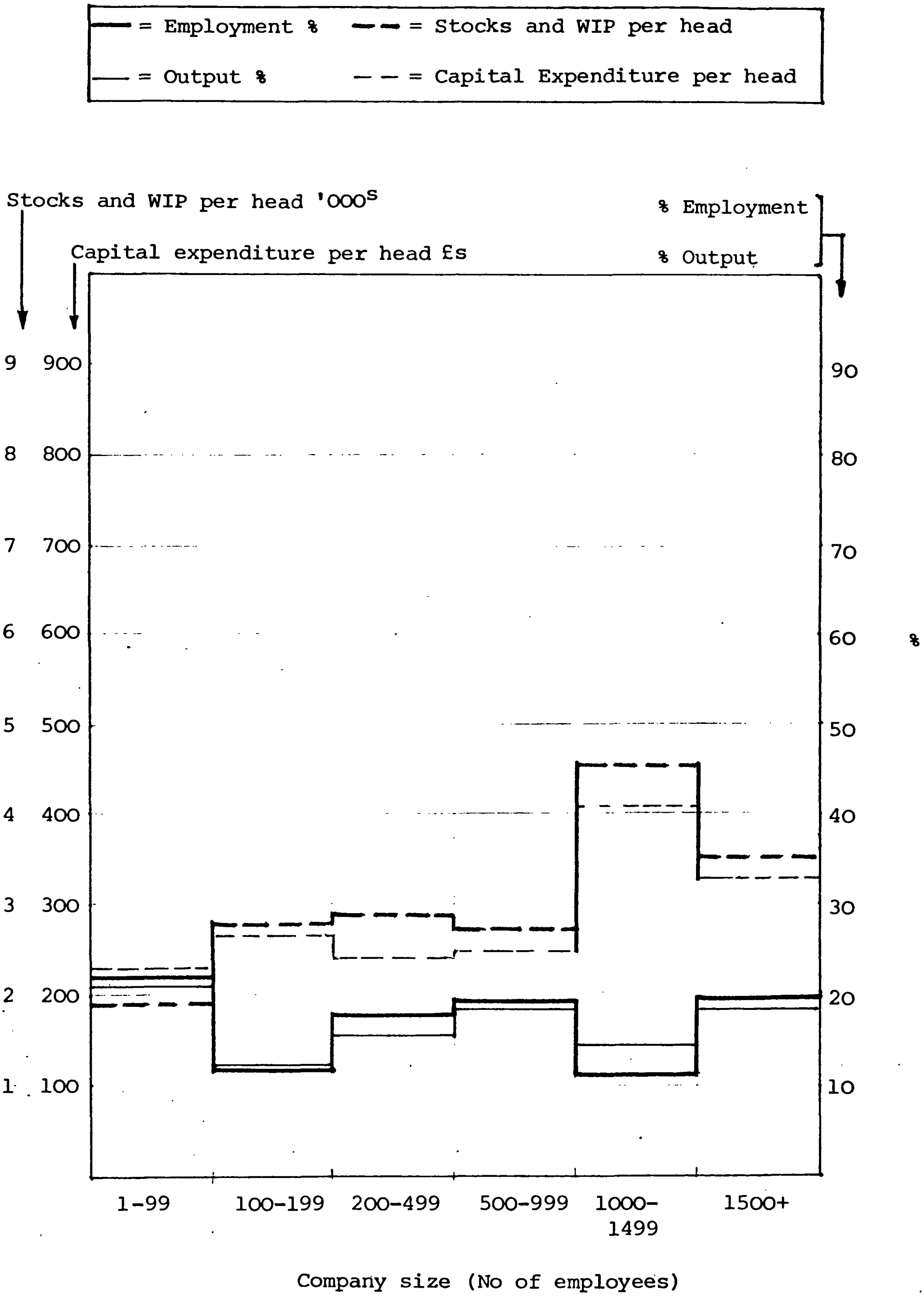
APPENDIX 2.4F

PAPER/PRINTING/PUBLISHING



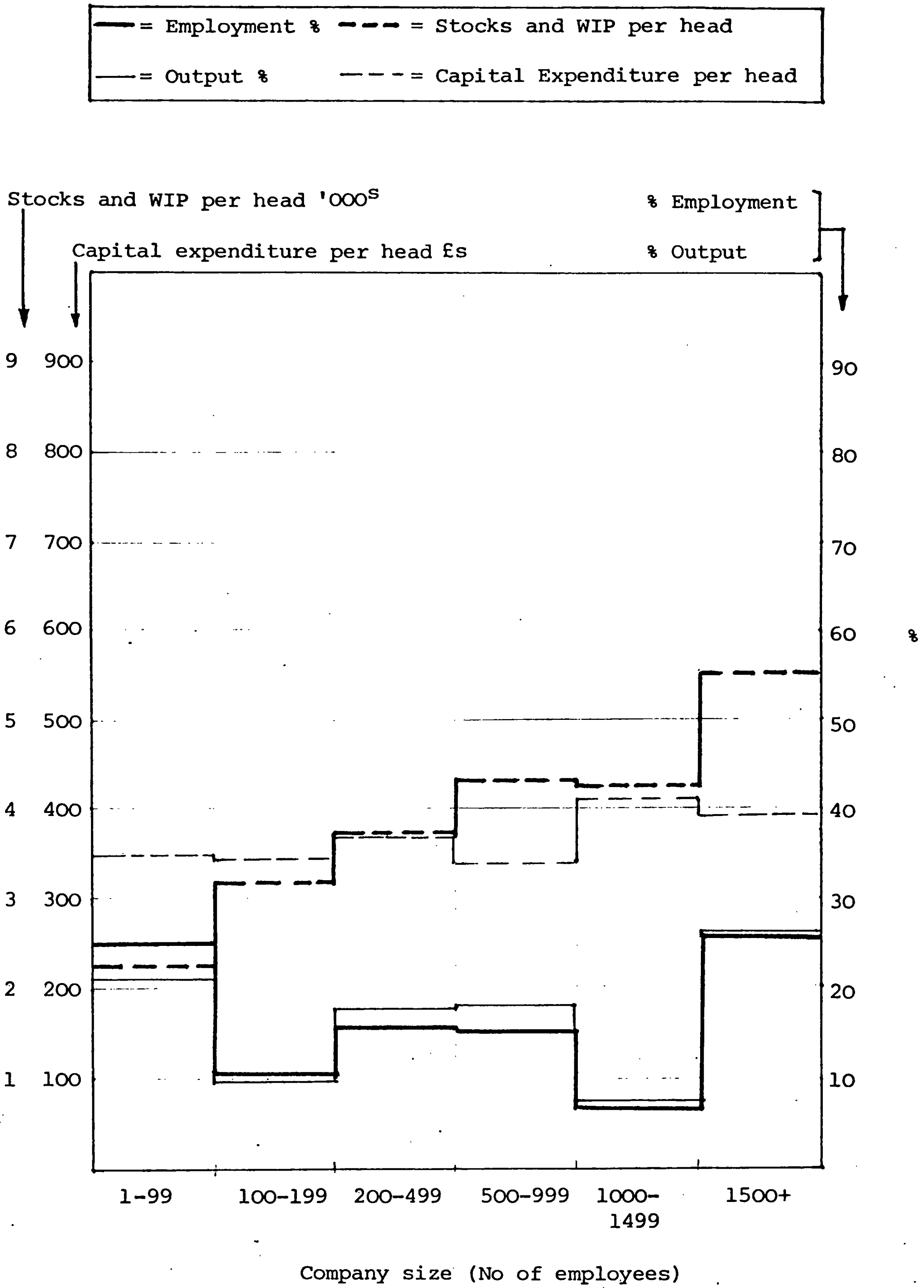
APPENDIX 2.4G

INSTRUMENT ENGINEERING



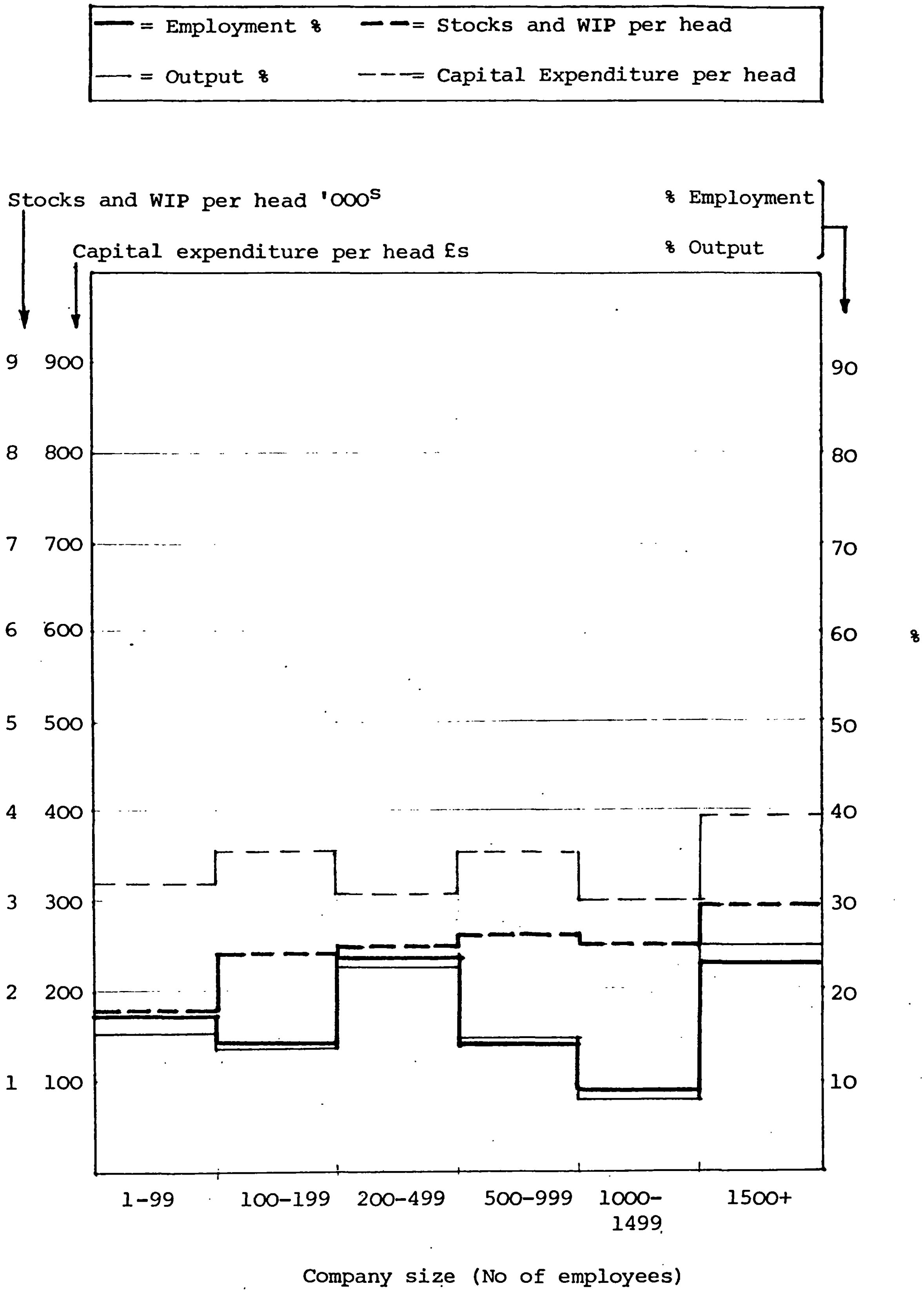
APPENDIX 2.4H

MECHANICAL ENGINEERING



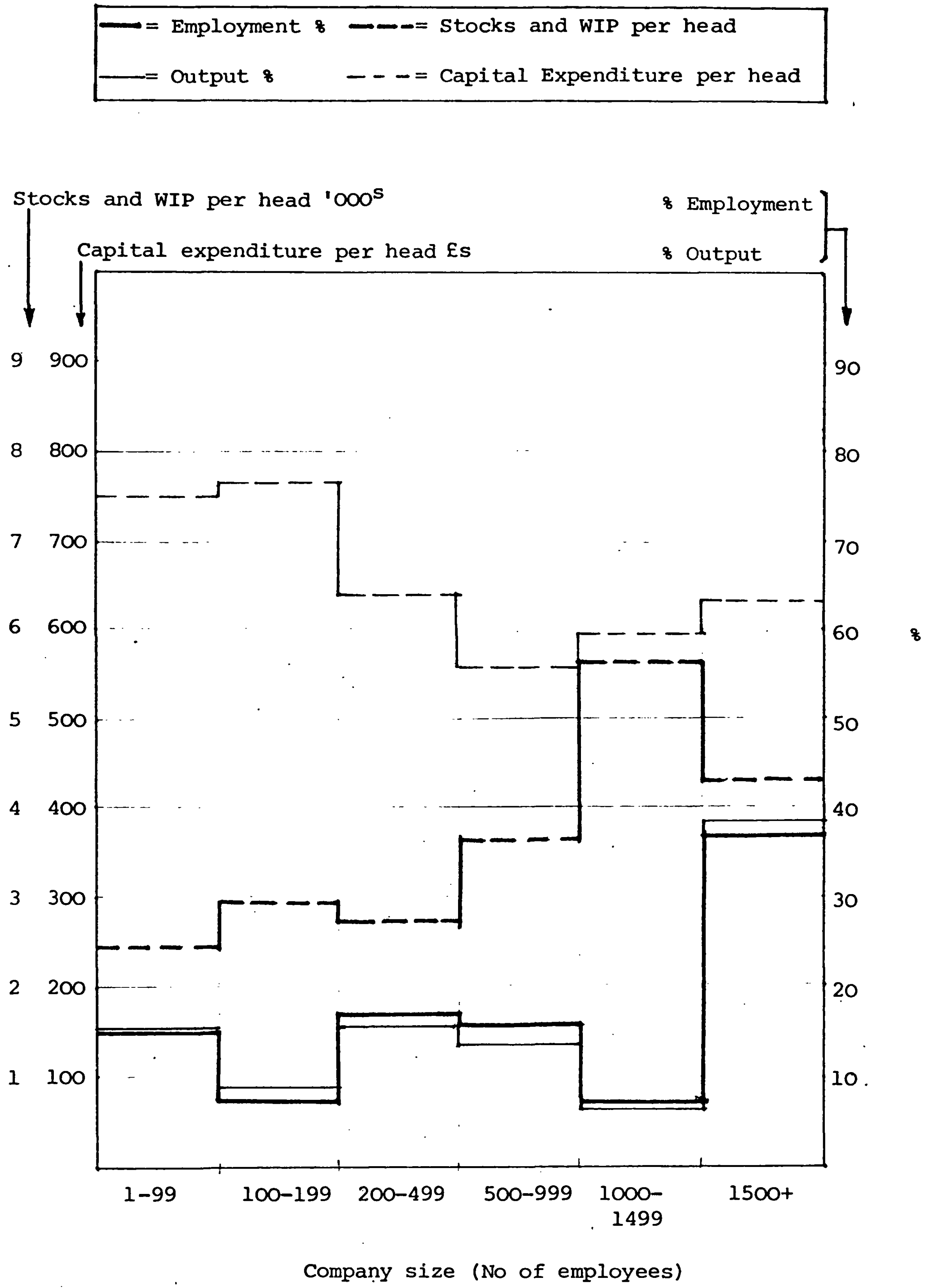
APPENDIX 2.4J

TEXTILES



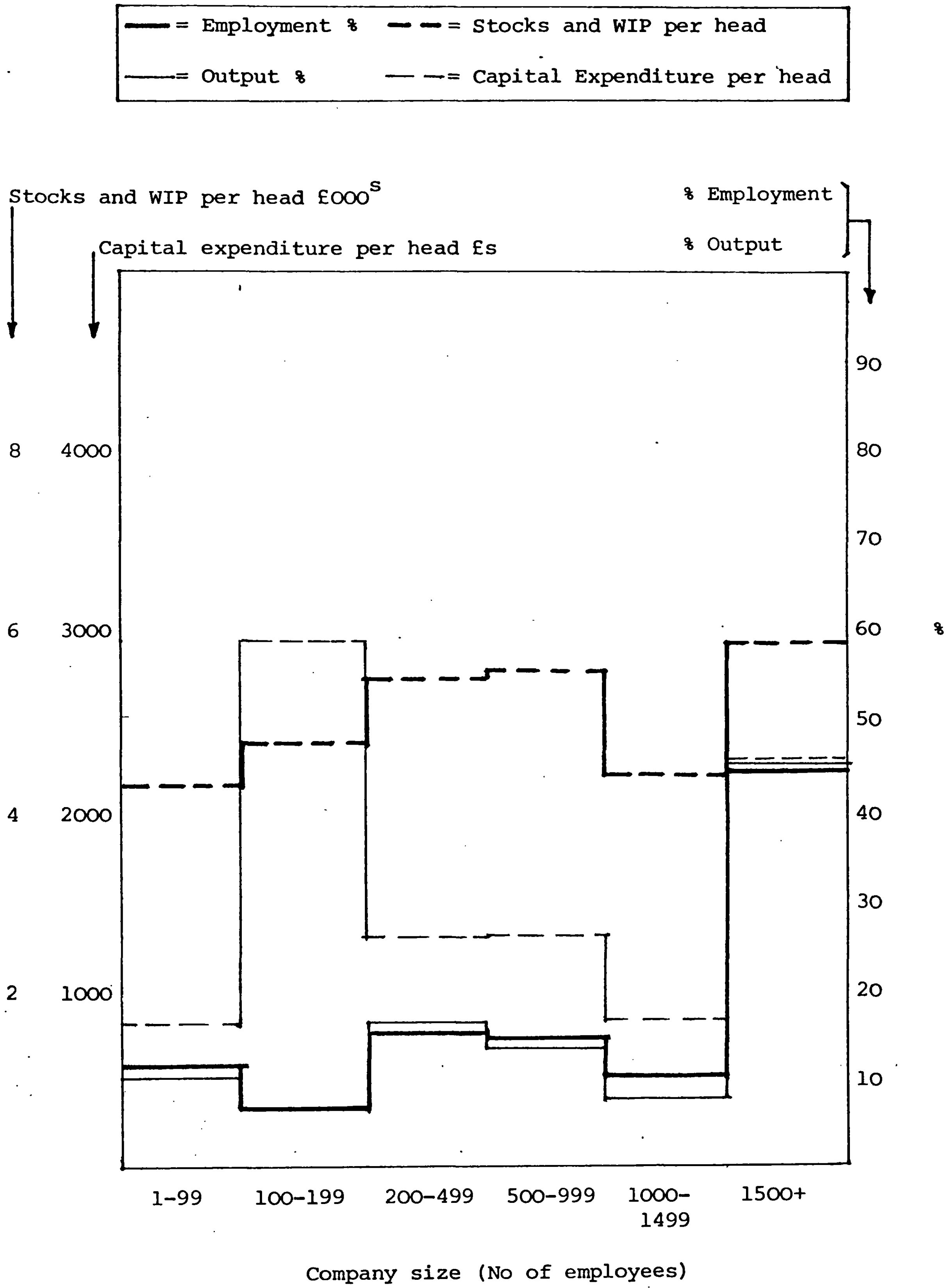
APPENDIX 2.4K

FOOD/DRINK/TOBACCO



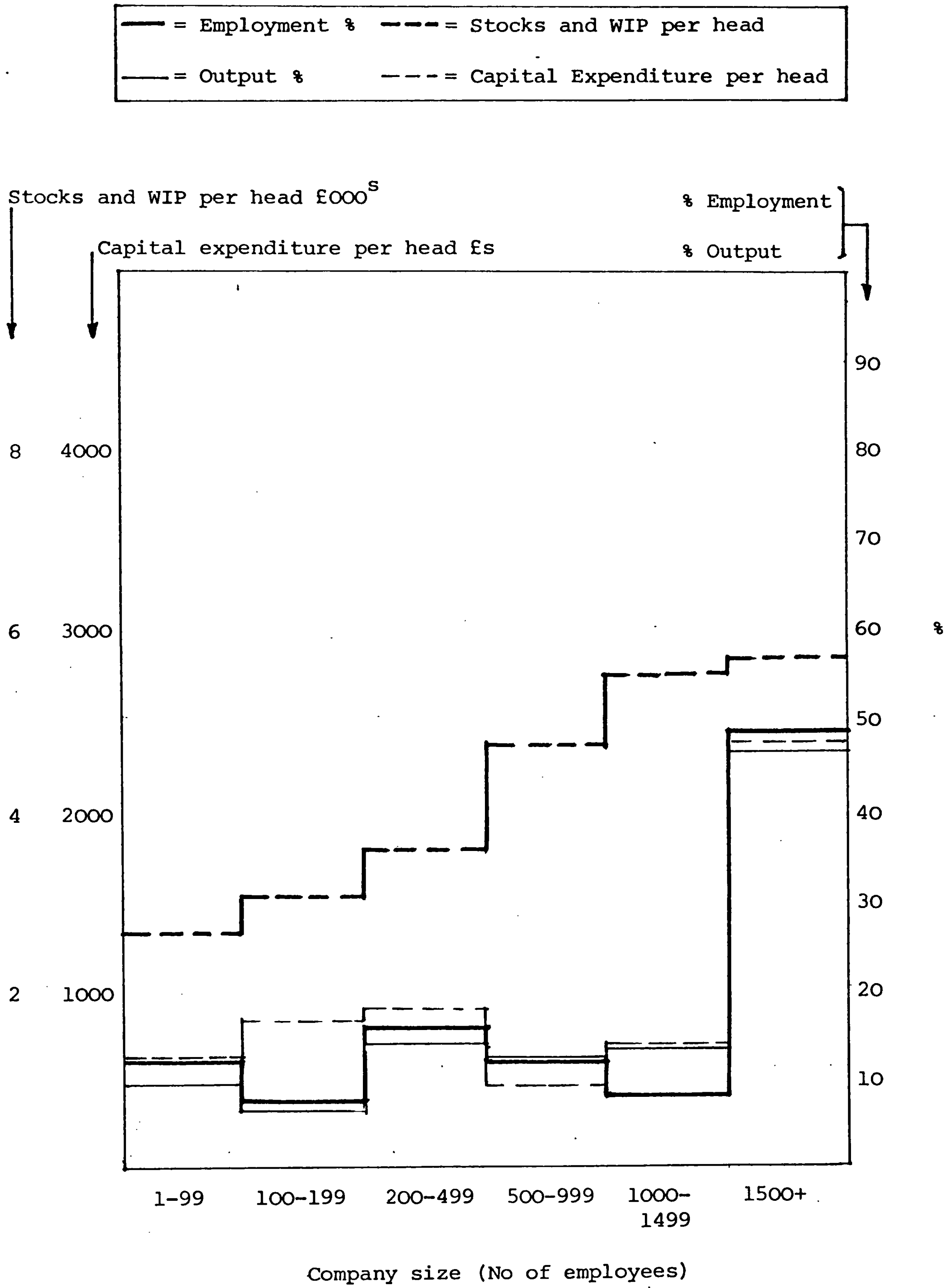
APPENDIX 2.4L

CHEMICALS/ALLIED



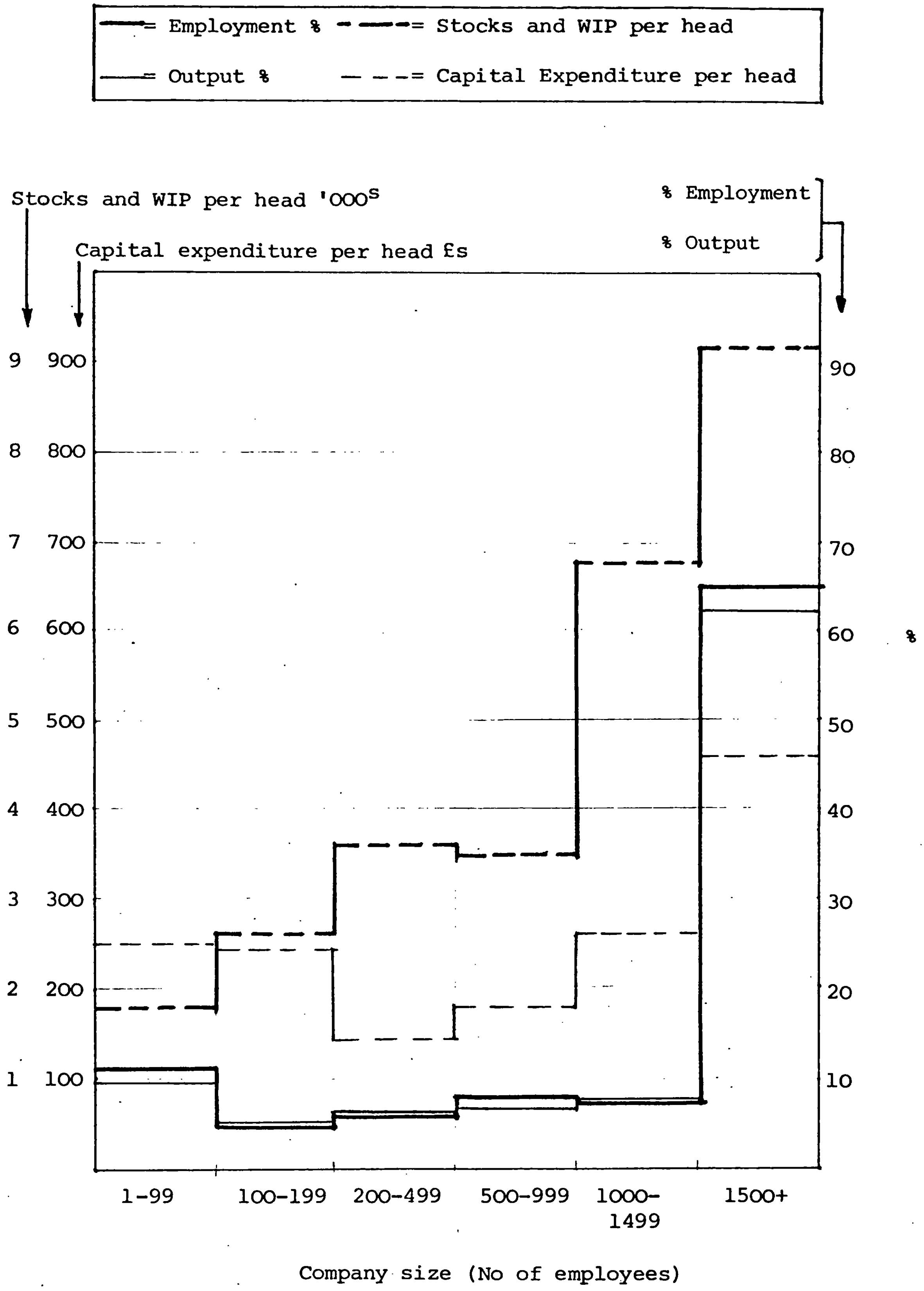
APPENDIX 2.4M

METAL MANUFACTURE



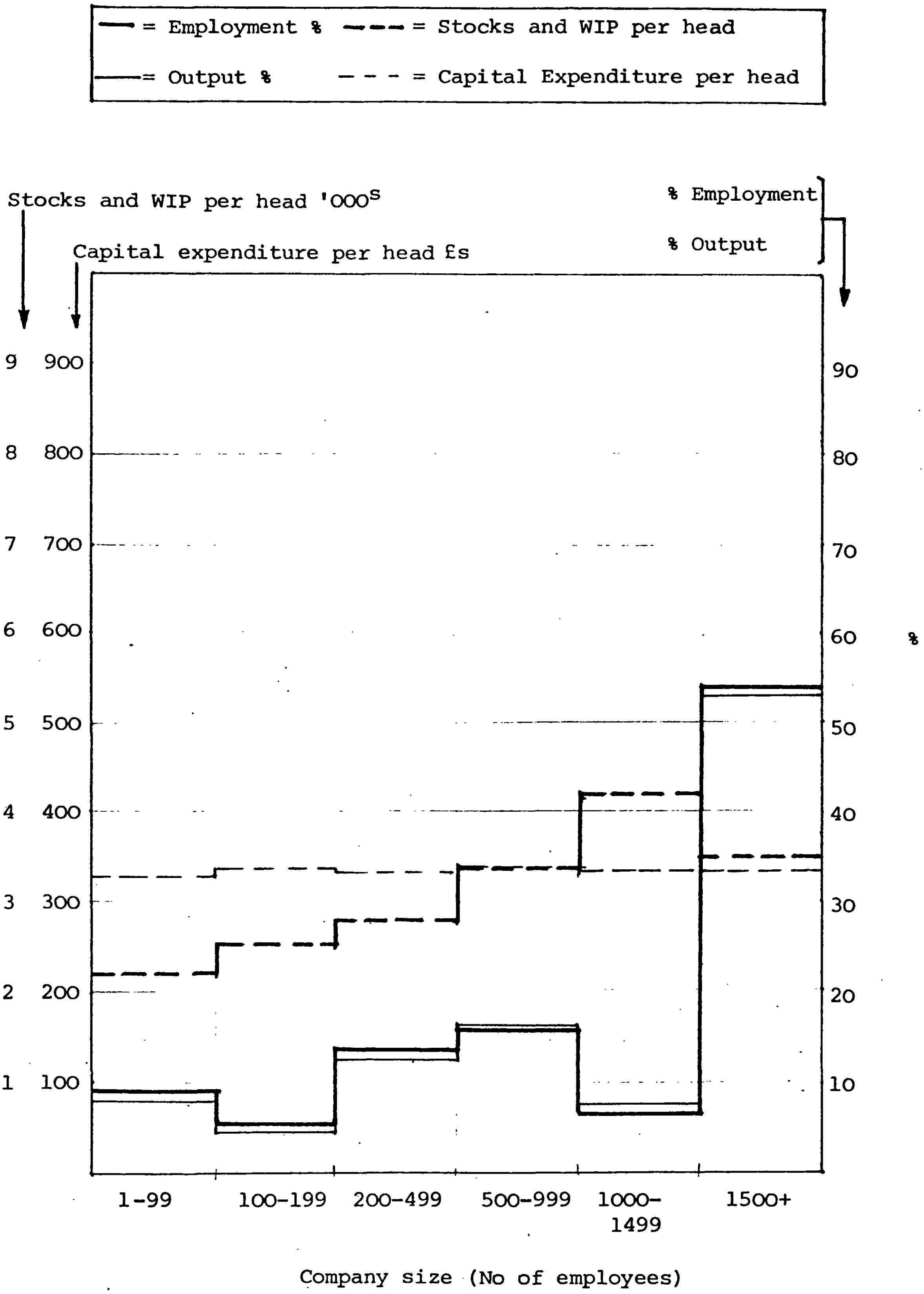
APPENDIX 2.4N

SHIPBUILDING



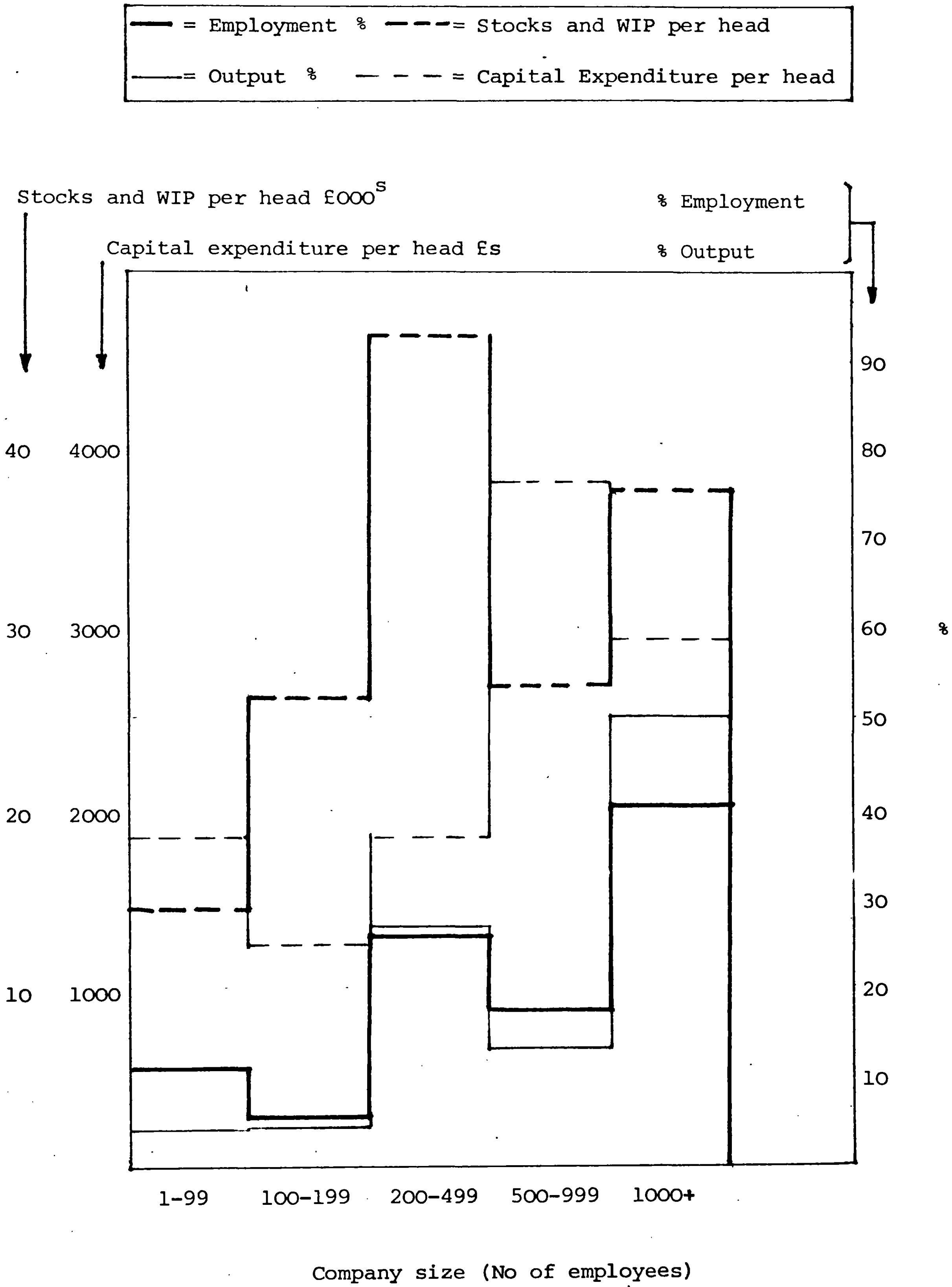
APPENDIX 2.40

ELECTRICAL ENGINEERING



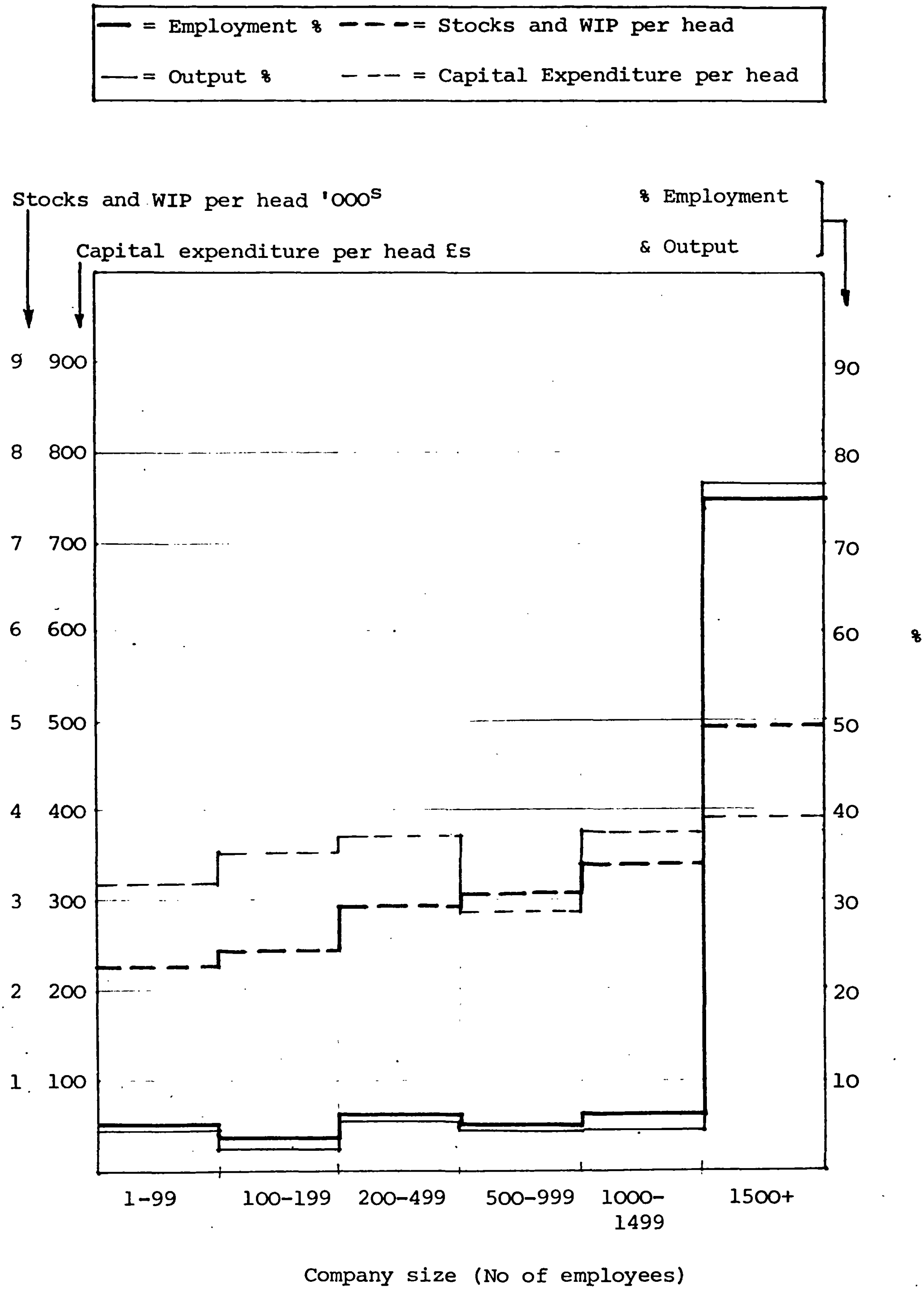
APPENDIX 2.4P

COAL AND PETROLEUM



APPENDIX 2.4R

VEHICLES



CHAPTER 3

DIVERSIFICATION AND THE SMALL FIRM

A INTRODUCTION

It was suggested in the previous chapter that small firms might be able to act flexibly in quickly taking advantage of opportunities that arose. Consideration of the methods by which such opportunities could be exploited were explored. Exploitation of new opportunities however, suggests movement either into new marketsutilising existing expertise or the development of current markets utilising new expertise. Both these alternatives suggest a diversification away from 'core' skills within the firm and towards the development of strategies to define best methods of managing such diversification. An examination of such strategies is, therefore, relevant in the scope of this thesis.

The chapter is structured as follows. First, examination is made of the theoretical framework within which companies might consider diversifying into new products or new markets. Examination is made of some of the 'models' that have been put forward to explain how firms diversify. Secondly, the empirical evidence for diversification in firms is reviewed. Thirdly, study is made of the extent of product and market diversification in a sample of smaller firms, utilising data obtained from published sources.

B STRATEGIC DIVERSIFICATION - A THEORETICAL FRAMEWORK

1. Definitions

It is frequently suggested that manufacturing firms either expand or contract, that it may be difficult for a company to attain a certain size and continue to operate at that size. For many firms a policy of growth is probably, therefore, an integral part of their strategy. Alternative methods of growth are to move into areas of the market place that the company has not operated in before, and with which it may be unfamiliar or to further develop current market segments.

Corporate growth by development into new markets, using new products, can, broadly speaking be defined as 'diversification'. However the differences between growth, integration of operations, and true diversification may not be so clear. While a large company launching a new product into a new market is clearly diversifying, the movement by a small firm from its one major product into another product, albeit in the same market, may not be classified as 'diversification' at all, even though the firm may be utilising new production and other skills.

The term 'diversification' as described above, is probably therefore, misleading to an extent. To encompass the product/market developments of both large and small companies may require a more broadly based definition. One way of defining the problem lies in considering diversification as a method of reducing 'risk'.[1] It would appear to be the case that concentration in one product, market, or in the case of the larger firm, industry, is inherently a risky strategy since problems beyond the firm's control in the market may adversely affect it. Development of new products with different characteristics for the markets in which the firm is currently operating, i.e. a strategy of product diversification, or the penetration of new markets with the firm's present product range, i.e. a strategy of market diversification, may overcome this problem. If the concept of risk reduction is a valid one to apply to diversification strategy then the concept of creating a portfolio of 'investments', in this case products, may lead to a reduction in that risk. A portfolio can be defined as "a combination of assets providing the highest possible return for any degree of risk."[1] For the small firm, therefore, adding additional products to its range may increase its assets and reduce its risks. In the same way, a large firm moving into new industries is also carrying out the same process. In both cases, the portfolio effect[1] probably operates to reduce the risk while tending to stabilise the potential return. It is probably for this reason that evidence suggests that while giant firms have on average a lower mean profit rate than small/medium sized firms, their profit level variability is also less, suggesting a trade-off of profit against stability of return.[2] The 'portfolio effect', can therefore be used to define any product/market development by

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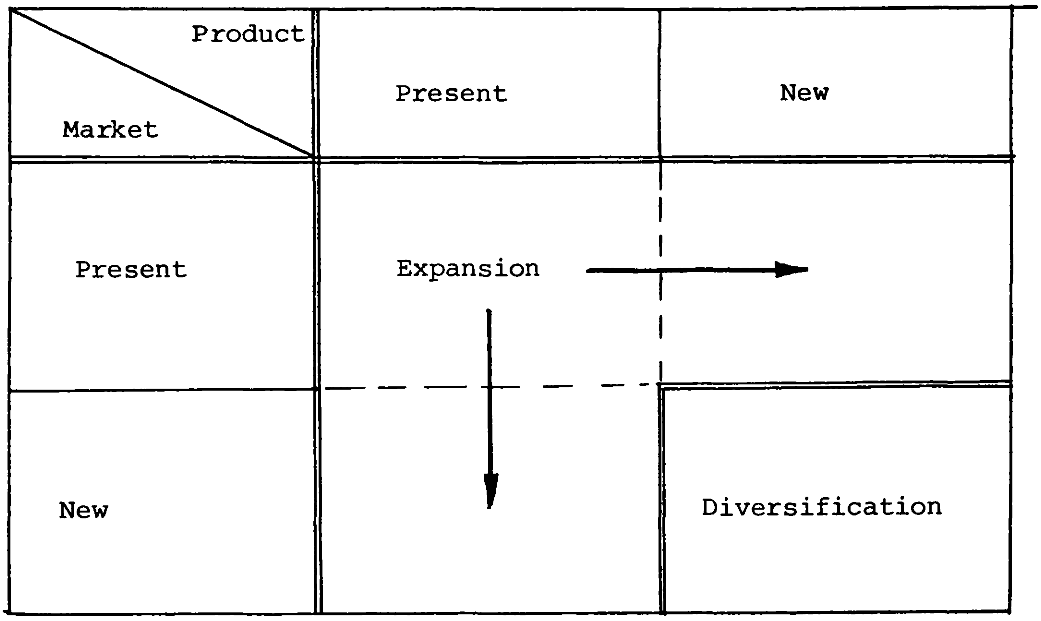
1. Weston, J F and Brighams, E F. 'Managerial Finance' 1979 Holt, Reinhart and Winston

2. Ansoff, H I (A) 'A Model for Diversification'. Management Science, July 1958

a company to reduce its risk, as 'diversification'. This model must be compared to the more traditional models proposed by such authors as Ansoff, which are described below.

Ansoff's definition of diversification, first proposed in 1958[1] suggests that a firm's operations in the market can be defined in terms of its product/market matrix. (Figure 1 below)

Figure 3.1



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1. Ansoff, H I (A) 'A Model for Diversification' Management Science July 1958

In the model, firms are defined as operating a product/market strategy in which the product mission of the company, or the job which it is endeavouring to do, is fulfilled by its product lines. Ansoff further breaks down product characteristics to physical or measurable characteristics and performance characteristics.

Within the product mission described, the manufacturer probably has three choices. Firstly he can expand his present range of products within the same market thus further developing his current product mission. Secondly he can expand the uses for which his products are designed thus fulfilling a further product mission in a mew market. The third alternative, developing new products for a new market(s) is defined by Ansoff as 'diversification'. While this definition is probably applicable to the larger company, its applicability to the small company, the subject of this thesis, is perhaps more problematical.

2. Diversification Pressures

Firms are likely to diversify for many different reasons. The diversification decision may be arrived at as the result of careful review of a firms' policies, strengths and weaknesses. In other instances, however, diversification may be forced on a firm by factors lying outside its immediate control.

Ansoff[1] defines the outside stimuli described above as 'triggers to change'. Many stimuli may be responsible for the diversification decision and force a review or a reappraisal of the method in which the firm operates. Some triggers that might lead to a decision to diversify might be:-

- Product reaching the end of its life cycle, sales dropping off/Technological obsolesence
- Increase in competitive pressures in a market where the firm has been pre-eminent hitherto
- Impact of safety legislation leading to a potential narrowing of the market or reduction in its size
- A decision to try to overcome a large seasonal fluctuation in sales

The trigger to change is likely to have the greatest impact when a large change in market/product relationships becomes apparent to company management. Management may then be forced to undertake immediate action to diversify away from the external threat. By reducing its dependence on the endangered market the firm may increase its chances of survival.

Smaller firms may be at an advantage in reacting to change, in that the <u>speed</u> of reaction, i.e. in appraisal of situations and development into new fields may be faster than in the larger firm in some cases. Lower capital intensity, greater labour/job mobility

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1. Ansoff, H I (A) op.cit.

within small companies and the smaller incidence of trade union demarcation lines may enhance this. Larger companies with specialised personnel and entrenched bureaucracy may therefore take longer to react to trigger signals than smaller concerns.

While there may be a large number of reasons for the diversification decision these can probably be grouped into major sub-headings. Staudt(1) writing in Harvard Business Review suggests a hierarchy of six major sub-groups for the diversification decision. He itemises these as follows in ascending order of importance.

- Survival - The continuation of the firm in its present form, by reaction to an outside threat.
- Stability - To eliminate potentially dangerous changes in the market, thus allowing for more accurate planning.
- Productive Utilisation of Resources - To maximise the firm's potential such that resources owned or managed by the firm produce the highest possible return.
- Growth - To expand the operations of the company into new areas of business and to increase the return for the company shareholders.
- Miscellaneous - Many separate factors but including maximising tax advantages and other reasons.

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1. Staudt T A 'Program for Product Diversification'. Harvard Business Review, Nov/Dec 1954

Such a hierarchy of reasons for undertaking a diversification programme would suggest that such a programme could be either reactionary, as a response to outside stimuli, or as a result of evolutionary pressures within the firm.

3. Types of Diversification

Where a company has decided or been forced to the conclusion that it must diversify, decisions must be made on the directions that diversification should take. Ansoff[1] considers that diversification can be classified into horizontal diversification, lateral diversification (which Ansoff further divides into concentric and conglomerate diversification as described below) and vertical diversification. Some authors would, however, probably describe vertical diversification, i.e. towards the source of raw materials from which the goods are made or towards the final product consumer as "integration" rather than diversification. However, in empirical work it has usually "proved impossible to distinguish systematically between vertical integration and diversification"[2] Utton further complicates the issue by defining diversification into "broad" and "narrow" spectrum. Narrow spectrum is defined under this convention as diversification by a firm along a narrow front into industries

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1. Ansoff, H I. op.cit. (A)
2. Utton, M A (A) Large Firm Diversification in British Manufacturing Industry. The Economic Journal, March 1977

"apparently remote" from the firm's primary activity. Narrow spectrum diversification therefore, broadly follows Ansoff's Horizontal and Vertical diversification while broad spectrum more closely conforms to his conglomerate diversification. For the purpose of this thesis the older (Ansoffian) terminology is adopted except that vertical integration is accepted to be a diversifying activity. The original Ansoffian model is described below.

Figure 3.2

	New Products	
Products / Customers	Related Technology	Unrelated Technology
Same Type	Horizontal Diversification	
Firm its own Customer	Vertical Diversification or integration	
Similar Type	Concentric Diversification	
New Type		Conglomerate Diversification

Vertical Diversification (or integration) is defined as a movement either up or down the supply line of raw materials to final consumers. The term integration then, defines the process of integrating the business in terms of moving the firm into the business of supplying itself with materials and acting as its own customer for the intermediate goods produced. Vertical integration suggests diversifying the firm away from where it used to operate however, even though the new areas of operation may utilise previously developed skills and experience. To describe it as diversification therefore seems reasonable within this context and also within the concept of "risk reduction" as defined above.

Examples of complete vertical integration (from raw materials to end users) are probably extremely rare since the skills involved at the extreme ends of the supply line are likely to be very different. Vertical integration on a large scale is therefore probably the prerogative of giant companies able to utilise the outputs of primary material plants while at the same time being able to sell final products to consumers on an equally large scale.

Horizontal Diversification is used to describe the process whereby new products are introduced to the firm's product portfolio within its current marketing expertise. Such developments might come about through 'in-house' R & D, licensing, or the purchase of other companies. While horizontal diversification into new product areas is likely to require changes in production technology these may be balanced by the similarity between the marketing operations required. In this case therefore, one factor in the product marketing mix is being held constant, as in the case of vertical integration or diversification.

Concentric Diversification can be defined as diversification where the new area of operation is similar to the old in one or more ways, for example through technology used, marketing methods etc.[1] Thus concentric diversification may include both horizontal and vertical diversification in some cases. In such instances products may be developed that are comparable with the original product line. In this case concentric diversification parallels horizontal diversification. Concentric diversification may also evolve from technical complementarity[2] where, for example, the skills of two groups of engineers are merged to form the know-how required to develop into a new area of technology. Concentric diversification is also analogous to Utton's narrow spectrum diversification (which also embodies horizontal and vertical diversification.)

Conglomerate Diversification might be described as the most radical diversification strategy since in this case the products into which the firm is diversifying may bear little resemblance either in

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1. Ansoff, H I (C) Corporate Strategy. McGraw Hill 1965

2. Steiner, G A. 'Diversification Planning' in Corporate Strategy and Innovation, Ed. Rothberg, 1976

production/distribution or marketing terms to current product ranges. Conglomerate diversification is considered to be analogous to the 'broad spectrum' diversification of Utton.

While conglomerate diversification might be anticipated to be more difficult and problematical than concentric diversification and therefore less likely to be undertaken by firms, this does not always appear to be the case. Ansoff[1] suggests several reasons for this. Firstly, the company may have the broad policy objective of 'developing profitable opportunities', thus undertaking new business wherever this may be found. Secondly, the capabilities of the firm may be too highly specialised or too obsolete to make it possible to diversify vertically or horizontally into related fields. Thirdly, the firm's depth of competence may be too shallow to offer opportunities for synergy. Any diversification in these cases would therefore have to be of a conglomerate type. Fourthly, it might be a strategic decision by company management to enter entirely new fields of operation, not based upon current strengths.

The advantages of conglomerate diversification might be several. Firstly, the overall profitability and flexibility of the firm may be improved through acquisition or development of companies or products in industries which have better growth or profit characteristics than those of the acquiring firm. Secondly, the conglomerate firm may have potentially greater access to sources of finance because of its greater contacts and spread of

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1. Ansoff, H I (A) op.cit

activities and this may lead to a more stable earnings potential throughout. Thirdly, the 'robustness' of the firm may be improved because of its greater spread of activities so that it may be better able to continue to grow when cyclical fluctuations in particular markets take place. It may be able therefore, to act to reinforce success in any one of a broader range of product areas than undiversified firms. Such firms may also be more likely to be exposed to a larger number of potentially profitable projects than undiversified firms. Despite its potential dangers, conglomerate diversification appears to be a growing method of development, particularly for larger firms.(1)

4. Review of Definition of Diversification Types

While the previously quoted 'Ansoffian' terminology has been adopted as a standard in many papers investigating and describing diversification strategies over the past twenty years, it is clear that its use and applicability in particular empirical studies has been less useful.(2) While it may be useful to describe product/market developments in terms of concentric, conglomerate diversification etc. relating such terms to the actual experiences of companies in practice, may be problematical. The separate

1. Utton, M A (A) op.cit

2. An investigation of empirical studies of diversification is made in the second part of this chapter.

concepts of 'narrow' and 'broad' spectrum diversification as suggested by Utton[1] may be more useful in these cases. Such terms encompass most product/market developments by companies without being particularly restrictive. The use of the portfolio concept of 'risk reduction' may also be helpful in analysing firms actions in developing diversification strategies.

A more practical approach to defining levels of diversification, possibly less prone to measurement problems, may be the use of the concept of market diversification rather than product diversification. By defining closely the market(s) in which the firm is engaged, and measuring developments in and movements out of that market, a picture of the diversifying activities of that firm could be built up. This approach would appear to be inherently more objective than measuring product development and then endeavouring to define that development in terms of horizontal, vertical, concentric or conglomerate diversification.

5. Potential Advantages of Diversification Strategies

Successful diversification may be a particularly difficult process to carry out. However, the major advantages of successful diversification are suggested to be: first, a more 'robust' organisation possessing a greater range of skills and greater

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1. Utton, M A (A) op.cit.

growth potential. 'Robustness' in a company is suggested to describe the strength of that company in meeting and reacting to threats or changes in its environment. Thus the effect of a change in the structure of one of its markets might be less profound than would be the case if the organisation was concentrated in one field. 'Robustness' might protect the firm from external factors that might otherwise be very damaging to it. Such factors might include the effects of product liability legislation or a change in consumer preference for a product.

The second major advantage of a successful diversification policy is suggested to be the development of a greater range of skills such that the firm is in a better position to exploit new ideas when these arise. Such skills might allow the firm to make better use of 'bought in' technology through licensing or other methods.[1] A broadening of the skill base may also lead to a greater pool of available knowledge within the firm when any new project is proposed. This suggests that higher skill levels would allow more accurate evaluation of new opportunities.

Lastly, by being diversified, a company must possess greater growth potential than it would have if it were concentrated in one particular industrial sector or with one product range. By operating in a large number of markets, the diversified firm may have the opportunity to direct resources to support developments

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1. Alternative strategies in obtaining new technology are also discussed in Chapter Five.

in those market segments that are growing. The undiversified firm may, however, be restricted to its current market segment, in which the growth potential may be low.

C. A REVIEW OF THE EMPIRICAL EVIDENCE ON DIVERSIFICATION

1. Introduction

The published works on diversification can be broadly divided into the theoretical and the practical. Many authors in the 1950s and the early 1960s concentrated on the reasons why companies might diversify. In particular, Ansoff[1,2,3] and Staudt[4] identified and codified reasons why companies might wish to diversify. Suggested definitions and the way such diversificationary processes came about were explored above. While potential theoretical frameworks for diversification were thoroughly explored at this time, the number of authors exploring the data from a practical viewpoint was relatively small. Two major exceptions, however, concern the work of Gort[5] in the USA and Amey[6] in the UK.

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1. Ansoff, H I (A) op.cit.
2. Ansoff, H I (B) Strategies for Diversification. Harvard Business Review. Sept/Oct 1957
3. Ansoff, H I (C) 'Corporate Strategy'. McGraw Hill 1965
4. Staudt, T A 'Program for Product Diversification' Harvard Business Review, Nov/Dec 1954
5. Gort, M. Diversification and Integration in American Industry. Princeton University Press, 1962.
6. Amey, L R. 'Diversified Manufacturing Businesses' Journal of the Royal Statistical Society. 1964 (A)

More recently, the thrust of study into the extent and process of diversification has swung more towards a practical exploration of the scope and role of diversification in manufacturing industry. Three major studies by Gorecki(1) Hassid(2) and Utton(3) have been carried out over the last ten years. These works have been complemented by several other probably less important studies, of which the work by Stubbs(4) is probably the most useful.

The works by Gorecki, Hassid and Utton may be regarded(5) as being of 'keynote' quality. Gorecki has concentrated on an inter-industry analysis of diversification across the full size spectrum of companies to ascertain the effect, respectively, of technology, product differentiation, research and development, industry growth and concentration in determining the extent of diversification.

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1. Gorecki, P K (A) An Inter-Industry Analysis of Diversification in the UK Manufacturing Sector, 1975. Journal of Ind.Economics

2. Hassid, J (A) Recent Evidence on Conglomerate Diversification in UK Manufacturing Industry. Manchester School of Economic and Social Research, 1975

3. Utton, M A. (A) op.cit.

4. Stubbs, P C. An Investigation of Diversification Patterns and Trends in UK Manufacturing Industry. SSRC Report December 1978

5. Devine, P J., Lee, N., Jones, R M and Tyson, W J. 'An Introduction to Industrial Economics' George Allen and Unwin, 1979.

Hassid's study concerned itself with measuring firms' rates of growth against degrees of diversification. Utton on the other hand in his study of large companies in the UK concentrated on the effects of diversification upon competition and in devising techniques whereby diversification could be measured. Using these measures, the extent of diversification in major industries was studied.

Most workers reviewed broadly agree that the level of diversification in the UK economy as a whole is increasing.[1] The importance of this process appears to be increasingly recognised as an important phenomenon worthy of more intensive study in the future. However, gaps within the accepted knowledge of the extent and process of diversification are still very great. One particular weakness in the published evidence is a concentration of studies of the large firm sector at the expense of medium sized and smaller firms. Few studies appear to have been made of diversification in the small firm sector *per se*. One of the major reasons for this may be the paucity of published statistics which could be used to measure diversification levels in small firms. Census of production figures[2] classify enterprises into the industry which accounts for the largest proportion of their employment while identifying firms as 'specialised' or 'diversified'. 'Specialised' firms are defined as being active only in their primary industry, while

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1. Devine, Lee, Jones and Tyson, op.cit

2. UK Census of Production

'diversified' firms are classified into their primary industry with the rider that they are 'active' in other industries. The census figures do not differentiate between firms widely diversified or narrowly diversified.

The census figures, like those of the UK Business Statistics office industry statistics are based upon the 'plant' or unit of production. Diversification <u>within</u> plants is ignored. The effect this might have on measurement of diversification in small firms (often with only one 'plant') is explored in greater depth later in this chapter. Its effect may have led researchers within this field to concentrate their studies on the large firm sector, at the expense of the small.

2. Reasons for Diversification

Although, as suggested above, diversification may now be recognised as a widespread, and important phenomenon, attempts to measure the reasons for and scope of diversification by companies have been made infrequently. The most often cited reasons put forward to explain pressures to diversify have been "stability, profitability and growth, or some combination of these"[(1)]

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1. Devine, Lee, Jones and Tyson, op.cit.

- <u>Stability</u>

The potential vulnerability of a firm operating in one market to cyclical fluctuations within that market would indicate that a search for stability might be one of the major advantages of a decision to diversify. Measurement of this factor has however apparently proved difficult. The only study reported, was that of Hassid[1] who endeavoured to measure the change in rates of growth in 'diversified' and 'undiversified' enterprises (subject to the problem of census statistics described above). Hassid reported that there was no apparent relationship between the extent of diversification and profit stability for industries <u>from</u> which firms diversified (i.e. their primary industry). For industries <u>into</u> which firms diversified however, there appeared to be a positive correlation between diversification and profit stability. This would seem to indicate that diversification might be seen by companies as leading to stability. One method of achieving such stability would be to diversify into industries more stable than the firm's primary industry and Hassid's results would tend to confirm that such movements do in fact take place.

- <u>Profitability</u>

While most of the empirical studies in diversification have endeavoured to measure the effect of diversification upon profitability, no concensus appears to have emerged. Indeed, the evidence is frequently conflicting. Growth out of a sector in

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1. Hassid, J (A) op.cit.

which a firm has a large market share would appear, potentially to be more likely to lead to expansion and greater profits, than endeavouring to increase market share in a primary industry. Hassid found no relationship between profitability and diversification for industries from which firms had diversified and a negative relationship between profitability and diversification for industries <u>into</u> which firms had diversified. Some evidence was reported, however, that diversified firms have a smaller <u>spread</u> of profitability between high and low profits, suggesting that diversification may help smooth variability of profits over time.

- <u>Growth</u>

The desire for growth, suggested above as a possible major reason for diversification pressure has also been associated with diversification by several authors. The results of empirical tests however appear to have been, in the main, inconclusive. While Hassid found a strong positive correlation between growth and diversification[1] Amey[2] found no tendency for more diversified firms to grow faster than undiversified ones.

3. Measuring Diversifications

The difficulties of accurately measuring 'diversification' have

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1. Hassid, J (A) op.cit

2. Amey, L R. op.cit.

already been discussed in previous sections. Firstly, what is meant by 'diversification'. Two meanings have been suggested by Devine et al.[1] Firstly, a measurement of the proportion of the firm's involvement in activities outside its main activity (as used in C.O.P. figures). Secondly a measure of the number of industries in which the firm is active. However, both these measures are subject to serious objections. While the first gives an indication of the importance of non-primary activities, it suggests no measure of the range of those activities. The opposite problem occurs for the second method. A firm with five products of which one comprises eighty per cent of output is clearly diversified to a different extent than a firm with five products, each of which contributes twenty per cent of output. The second method outlined above could not differentiate between the two companies. Ideally both methods should be used in conjunction, but problems in the way available data is presented are suggested to make this impracticable.

A second major problem in measuring diversification lies in the nature of the available data. Major sources used for measuring diversification in the UK have been census of production figures and statistics compiled by the Department of Industry from individual firms. These latter figures are the basis for statistics issued in UK Business Monitors, etc. Such sources appear to be flawed in two ways. Firstly, the data collected for statistical purposes is limited in its public availability (for reasons of confidence the UK Department of Industry refuses to release certain

1. Devine, Lee, Jones and Tyson, op.cit.

information) to a classification based upon the 'main activity' of each 'plant'. (A plant is defined as an establishment which could comprise a company with one factory, or a subsidiary factory of a group). Thus a company producing goods in the proportion 2X to 1Y in one plant would be classified under industry X. If the company had two plants producing X and Y in the same proportions, the plants would be separately classified in industries X and Y respectively. The implications of this method of data collection and presentation are particularly profound in the case of the small company which, because of its size, is more likely to possess only one plant, however diversified its products may be. Thus the number of plants imposes a maximum figure on the level of diversification that can be measured. The more plants a firm possesses, the greater its apparent degree of diversification (depending on how the output of each of those plants is classified and the classification used). Since the numbers of plants as suggested above is likely to be connected to the size of the firm, size and diversification may appear linked, with diversity varying on the basis of the output classification. This factor might partly explain the inconclusive results found by researchers in this field when trying to correlate diversity with profitability, growth etc. While some researchers have recognised that the plant is probably not the most suitable basis for measuring diversity, little weight has been given to this. Gorecki[(1)] however, suggests

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1. Gorecki, P K (B). 'A Problem of Management, from Plants to Enterprises in the Analysis of Diversification' A Note. Journal of Industrial Economics, March 1980

that census techniques "typically understate the degree of enterprise diversification", so the problem does appear to have been recognised in this instance.

A second flaw in the sources of diversification statistics may lie in the variation in the way levels of aggregation have been used, i.e. the number of groups of 'industries' used to classify activities. Since "measurement of the extent of enterprise diversification depends crucially on the level of aggregation used"[1] this may lead to problems in analysing the trend of diversification. Disaggregation to a large(r) number of product groups is likely to lead to an apparently larger degree of diversification than if only a small number of groups is used. An emphasis on product rather than market classification might also tend to lead to a greater apparent degree of diversity. Problems of measurement may, therefore, make it difficult to come to definitive conclusions regarding diversification. They may also lead to problems in comparing the results of different empirical studies with each other.

Of the techniques used by researchers to measure diversity in practice, that used by Utton[1] is probably the most widely accepted. To a degree, Utton's technique overcomes the measurement problem described above. Utton bases his measure on the 'enterprise cumulative diversification curve' as described below.

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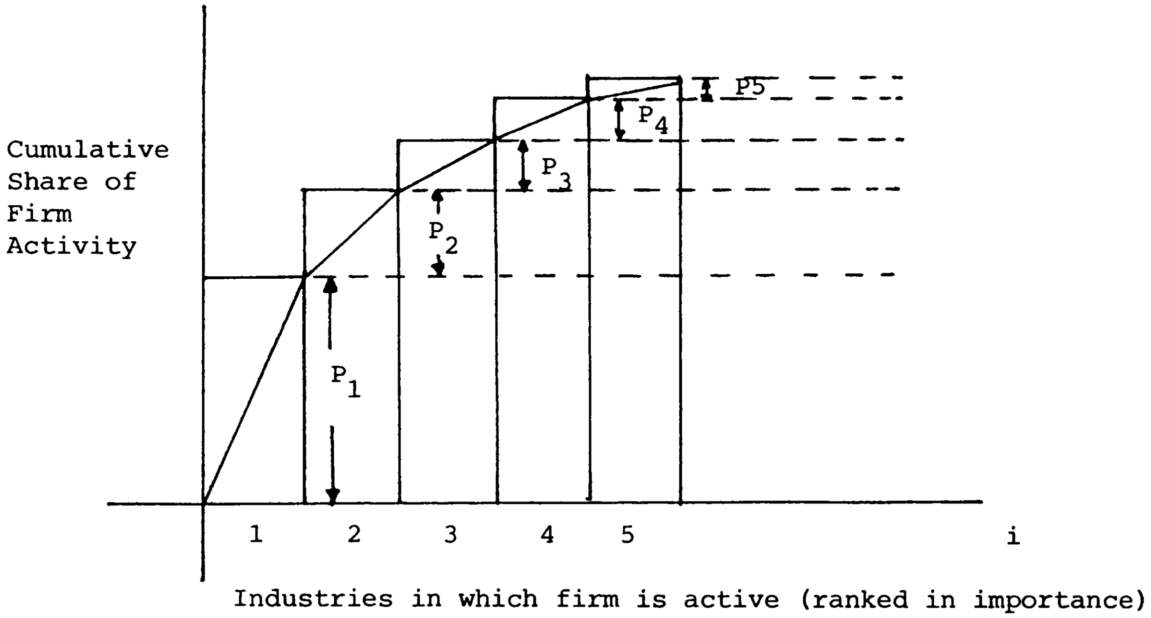
1. Utton, M A (A) op.cit.

Figure 3.3



The analysis used by Utton is based upon an area measurement defined as twice the area above the 'diversification' curve and can be expressed as

$$W = 2 \sum_{i=1}^{n} ip_i - 1$$

Where Pi is the proportion of the firm's activity in the ith industry and i is the number of industries in which the firm is active. W is therefore a weighted average index where a score of 1 will occur for a firm completely specialised (i.e. in one industry) and where a score of (say) 5 is equivalent to that firm's operating equally in five different industries (although it might be operating in many more), but with a very small percentage of output in each. However, the objection noted above, namely that the data used was based on 'plant' statistics, still applies.

Gorecki[1] as noted above, studied this problem by attempting to measure the accuracy of 'plant' data as a reflection of the enterprises' actual output. His conclusions implied that "enterprise diversification measures released by census authorities typically understate the degree of enterprise diversification". The method of presenting data from government sources had a large effect on the accuracy of the results, with particular weight being given to variability introduced by disaggregating output to a greater number of product groups. At all levels of aggregation, shortcomings in actual compared to predicted values were seen. More accurate measures of output than 'plant' statistics would therefore seem necessary before any fully acceptable measures of diversification can be made.

4. The Extent of Diversification

While the problems associated with the available data have been explored above, there would seem to be no reason to doubt the accuracy of the data at a purely 'plant' level. The census classification of 'specialised' or 'diversified' companies on the basis of their employment in particular industries may therefore be a valid measure, particularly for those larger companies operating a number of plants. The analysis of the census figures over time has however, once again, led to unclear results.

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1. Gorecki, P K (B) op.cit.

Hassid[1] and Amey[2] using data for 1958, 1963 and 1968 found the following results:

TABLE 3.1

Percentage ratio of secondary to total output: average for UK manufacturing industry

Study	1958	1963	1968
Amey	14.2		
Sawyer	14.6	19.3	
Hassid		14.0	16.9

Reproduced from Devine[3]

The table suggests no clear trend in the degree of diversification over time for UK Manufacturing Industry. However, between 1958 and 1968 the basis upon which statistics were collected was changed, and if this is taken into account[3] it does appear that the level of diversification is increasing over time. In view of the problems mentioned above, however, drawing conclusions from these figures would probably be unwise.

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1. Hassid, J (B) Diversification and the Firm's Rate of Growth. Manchester School of Economic & Social Research, 1976

2. Amey, L R. op.cit

3. Devine, Lee, Jones and Tyson. op.cit.

The study by Utton[1] using unpublished data provided by the UK Business Statistics Office may be the most detailed investigation carried out to measure the extent of diversification in the UK. Utton carried out studies into the diversity of the largest 200 UK manufacturing firms. While the statistics he used are subject to the objections noted above, particularly with reference to the use of the 'plant' as the basic unit, this factor may not be so important in the case of large firms, since it might be anticipated that large firms would be more likely to carry out separate activities in separate plants. Utton's main finding was that the average share of total employment accounted for by the 200 firms' primary activity was 57% and the average for the three largest industries was 80%.

Coal and chemicals, textiles, metal manufacturing and electrical engineering were found to be highly diversified while vehicles, instrument engineering and shipbuilding were found not to be so diversified. However, it would probably be unwise to regard these results as conclusive since "there is reason to suppose that in the first three groups above, some of the secondary industries represented vertical integration rather than diversification."[2] The measure of diversification used probably affects the final result. While Hassid[3] found the metal manufacture and coal and

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1. Utton, M A (B) 'Diversification and Competition'. National Institute of Economic and Social Research. Economic Journal, August 1978
2. Devine, Lee, Tuson and Jones, op.cit
3. Hassid, J. (B) op.cit.

petroleum products groups as being highly diversified, he disagreed with Utton in finding electrical instrument engineering to have approximately the same degree of diversification. This conflicts with Utton's evidence where these industries were placed at opposite ends of the diversification spectrum.

The most recent 'in-depth' study of UK manufacturing diversification reviewed as part of this study, was made in 1978 by Stubbs[1] who, once again used data supplied by the UK Business Statistics Office. His major findings were that diversification appears to be increasing, with an orientation towards growth rather than increasing profits, in both the 'broad' and 'narrow' spectrum sense.

In conclusion diversification appears to be an increasingly important factor in UK manufacturing industry[2]. Nearly all writers however equate size and diversity either explicitly or implicitly. This connection may be true for larger companies; there appears to be little published material available reporting the diversity of medium and small companies.

5. Large Company Diversification

From the studies that have been carried out into diversification, it does appear that, at least at the level of medium to large

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1. Stubbs, P C., op.cit

2. Although the apparently growing numbers of management buyouts and divestments in the 1984/85 period suggests that further empirical work on changes in diversification levels over this period would be useful.

companies, size and degree of diversification are related. Both Gort[1] in the USA and Amey[2] in the UK found this relationship. Utton's study of the largest 200 UK manufacturing firms showed a clear relationship as shown in the table below.

TABLE 3.2

Diversification and size among the 200 largest manufacturing firms in the United Kingdom

Company number (rank)	Mean*	Maximum Diversification *	Minimum*
1 - 50	3.85	14.29	1.00
51 - 100	3.33	16.67	1.00
101 - 150	2.94	12.50	1.00
151 - 200	2.63	8.33	1.00
1 - 200	3.23	16.67	1.00

* Note - Measure of diversity used is the 'W' index where W equals the degree of diversity on the scale of W = 1 for undiversified enterprise to W = n for enterprise diversified into n industries. (equally) (3)

The results reported by Utton are, in general, confirmed by the work of Hassid[4] who found that "the average ratio of primary to secondary employment increased systematically with size to a

1. Gort, M. op.cit
2. Amey, L R. op.cit
3. Utton, M A. (A/B) op.cit.
4. Hassid, J. (B) op.cit

maximum of 22% in firms with over 5000 employees." There appears to be, therefore, a degree of agreement that diversification increases with firm size, particularly in the case of the larger firms.

6. Small Firm Diversification

There appears to be a paucity of papers exploring the levels of small firm diversification. Nearly all the studies that have been carried out into diversification appear either to ignore small firm diversification altogether (for example, by taking a sample of companies excluding small firms), or analyse their degree of diversification in the same way as for large firms. It has already been noted that the data used in most studies appears to be based on 'major activity at plant level', thereby "ignoring any diversification within the plant". (Utton)[2] It would probably be unwise therefore, to come to any conclusions regarding the degree of diversification in small firms. The study reported below endeavours to explore this area taking into account the Bolton Committee Findings [1] that the average number of 'plants' per small enterprise in manufacturing UK industry is 1.3 (UK) and 1.5 (US).

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1. Bolton, J E 'Report of the Committee of Enquiry on Small Firms. HMSO Cmnd 4811, 1971

2. Utton, M A (A) op.cit.

7. Factors Explaining Diversification

Three major factors that have been suggested as being potentially correlated with degree of diversity in manufacturing industry have been cited as advanced technology, size and industry. 'Advanced technology' is defined as areas where the R & D to sales ratio is high, the numbers of scientists/researchers is high etc. Such factors have consistently been related to the degree of diversification. Amey and Hassid[1 and 2] found, using the census statistics for 1963 and 1968 that between one fifth and two thirds of all the variation in the extent of diversification could be 'explained' by variations in the number of technical personnel. One interesting conclusion of Hassid's work may be the implication that an increase of 10% in the employment of scientific manpower is associated with an increase of 3-4% in the index of diversification. This might suggest that there are more opportunities in science based industries for diversification and that firms with high R & D capabilities may be in a better position to exploit those opportunities than firms without such capabilities. Utton[3] codified this relationship as "an increasing importance attached to R & D is likely to bring with it an increase in diversification". Utton sees the diverse company as being better able to exploit any 'breakthrough' in R & D which may or may not be in the original research area.

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1. Amey, L R. op.cit.
2. Hassid, J. (B) op.cit.
3. Utton, M A. (A) op.cit

Clearly, a wider range of products already being sold increases the chance that the new product will, potentially, fit into the product line, and hence will be absorbed into the firm's product portfolio rather than be shelved or sold to another firm under a licence or other agreement.

A relationship between size and diversification has already been noted. However, size may not always be a good guide to the degree of diversity. As Utton points out in his study, even in the largest companies within each group there was always at least one firm that operated only within one (three digit) industry. Growth to giant size may therefore not always correspondingly result in the development of diversified activities. Subject to the reservations expressed in the previous section however, size would appear to be a useful pointer to diversity.

The industry in which companies operate is probably related to the degree of diversification. This subject has been explored above. However, the results reported are to a degree ambiguous in that different researchers classify different industries as diverse and undiverse. Clearly however, some industries are more diverse than others, with general agreement amongst workers that coal and chemicals and metal manufacture are subject to more diversification than other sectors. This may be related to diversification opportunities being more readily available in industries close to these sectors.

D. A STUDY OF SMALL FIRM DIVERSIFICATION

1. Background

The diversification alternatives open to small firms may differ in scale and type from those opportunities open to the larger companies.(1) The number of products sold by the small company may be less than for larger companies, and in this sense the small firm may be starting from a less diversified base than some larger companies. Small companies' markets may also be more concentrated (even if in diverse industries) than in the case of the larger firms. Within such concentrated markets however, smaller firms may be specialised (with one small market niche in which they have a relatively large market share), or be operating in conditions of high competition (with extremely small market shares).

Dependence on a small number of products may make the small firm more likely than its medium or large sized competitors to consider diversification. Small market niches are likely to have a relatively low potential for growth and may be prone to cyclical changes in demand. Such movements might be anticipated to make the firm consider diversifying into new products/markets. Pressures on those small firms in the more competitive markets may be conditioned by a desire to specialise, or to enter other markets of a similar type to those in which they already operate, in order to grow.

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1. Mason, R S. 'Product Diversification and the Small Firm' Journal of Business Policy, Vol.3, No.3, 1973

Since the smaller firm may have less resources to devote to new product development than larger firms, the risks of broad spectrum diversification are likely to be greater for the small than the large firm and this might be expected to lead to pressure to diversify into activities close to present areas of competence.[1] Thus in view of the risks involved,the most viable diversification alternatives open to the small firm might be expected to be of low capital intensity and in areas reasonably close to its competence either in production or marketing terms. Large capital intensive projects would clearly be inappropriate for such firms in any diversification strategy. Entry by the small firm into new markets might therefore be expected to be on a small scale and to be of low cost in most cases.

It may be inappropriate to apply the concepts of vertical, horizontal, concentric and conglomerate diversification too closely to the diversification activities of small firms. For a small firm considering taking on a new product to complement its current single product line, any new product would be a 'diversification'. In terms of the product choices made by small companies wishing to diversify, Mason[1] suggests the factors in the table below as the new product performance criteria that small firms should consider. These are compared to the same criteria as viewed from the large company viewpoint. Brioni[2] defines such comparisons as "the product scope of interest".

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1. Mason, R S. op cit

2. Brioni, J M. 'Corporate Market Planning'. Wiley Marketing Series, New York, 1967

TABLE 3.3 New product performance criteria for large and small firms

Product requirements	Company A (large)	Company B (small)
Capital investment	High	Low
Sales volume	(1) Large volume	(1) Small volume
	(2) Mass markets	(2) Specialized markets
	(3) Many applications	(3) Many to few applications
	(4) National distribution	(4) Local or specialized distribution
Similarity to present distribution	High to moderate	High
Effect on existing products	Good to fair	Good
Competition	(1) Relatively few companies	(1) Few to many companies
	(2) Sound pricing	(2) Sound pricing
	(3) Good possibility of securing a large percentage of the market	(3) Desirable market position variabl
Cyclical stability	High	High
Technical opportunity	Great	Moderate to small
Patent protection	Great	Great to none
Raw materials	(1) Basic materials	(1) Intermediate or basic materials
	(2) Many suppliers	(2) Many to few suppliers
Manufacturing load	(1) Standard products	(1) Standard or custom products
	(2) Mass production	(2) Specialized production
	(3) Few grades and sizes	(3) Few to many grades and sizes
Value added	High	High to moderate

Reproduced from Mason, op.cit.

The criteria upon which a small company might decide to adopt a new product may also be different from those of the larger firm, and the table suggests alternatives for this. Webster[(1)] relates such new product analysis by means of criteria to a suggestion that small supply or production oriented firms desiring growth through product diversification should consider first the adoption of product imitation as a strategy, followed by new product development, vertical and then horizontal acquisition. In common with many writers in 'diversification', however, Webster does not attempt to relate his model to empirical data and any conclusions based on the model must therefore be somewhat tentative.

There is little empirical evidence to define the methods, successes and failures of small firms in developing diversification strategies. It is an intention of the following study to explore such strategies with the objective of both measuring and endeavouring to explain the levels of diversification in a sample of small firms.

2. The Small Firm Study

It has already been hypothesised that small firms may be able to diversify more easily than large sized firms in certain instances. However, to investigate the levels of diversification in small

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1. Webster, F A. 'A Product Diversification Growth Model' American Journal of Small Business, April 1977

firms it was necessary to collect empirical data on which an analysis could be carried out. The problems of utilising governmental statistical data have already been described. It was clear therefore that these sources would not be suitable for an analysis of small firm diversification. A more direct method of collecting data was therefore employed to attempt to answer the following questions.

(i) What is the extent of diversification in small and medium sized companies?

(ii) Is size correlated with diversification in the small/medium size firm sector?

(iii) Are diversified and non-diversified small firms concentrated into different industries?

(iv) What factors appear to be related to diversification in small/medium sized firms?

3. Method - Data Collection

Five hundred randomly chosen small (10-200 employees) and medium (201-1000 employees) sized companies were analysed for their degree of diversification by their product classification in the reference book 'Kompass'[1] which classifies more than

1. Although the 'KOMPASS' data provided a potentially large sample for the study, the following data deficiences were recognised. First, that the sample was 'self selected' (since entry in the reference book is by subscription) and second that not every company entry was updated every year. This might suggest that the most 'entrepreneurial' companies would be relatively overpresented in the sample.

thirty six thousand UK companies by product group and geographical location. Within Kompass, product/industrial group classification is into one of thirty headings. When sectors such as Business and Professional Services, Banking Finance, etc. are excluded, a total of twenty two industrial groups remain. These groups comprised the basis of the diversification measure used in this study. A further sample of 50 large companies, (1000+ employees) obtained by reference to 'The Times 1000' companies, was analysed in the same way, to complement the main sample.

Each sample company was chosen within the following parameters:

(a) That the company was independent, i.e. not owned by another company or part of a larger group
(b) That it had no more than 1000 employees (for the main sample)

The large companies, chosen on the basis of the Times list of 1000 largest companies were selected as follows. Each twentieth company within the list was included in the sample to give a spread from giant to medium size. Where a company was not involved in manufacturing industry, the next company on the list was included in the sample. The entire spectrum of company size was covered within a total sample of five hundred and sixty nine companies. For each company the following information was collected:

(a) The number of employees
(b) The number of product groups into which it was classified
(c) The actual product groups into which it was classified

Since the product group classifications in 'Kompass' relates to actual products produced by the companies and listed in the same publication it is considered that this data should be extremely accurate. However, in terms of its statistical usage it is recognised that the measurement was of numbers of industries into which each company was classified. No measure was made of the relative importance of each product or product group to the company in terms of percentage of output etc.

4. Data Presentation

The objectives of this part of the investigation, as noted above, comprised two major themes. Firstly, to discover the relationship, if any, between the size of companies (measured by the number of product groups in which they were operating), The second objective of the investigation was to discover if diversified and non-diversified firms were concentrated into particular industries. The data presented in Appendices 3.1, 3.2 and 3.3 relates to the first objective while that in Appendix 3.4 relates to the second.

- Appendix 3.1 - Companies classified by size
  This appendix comprises a breakdown of the sample of 569 companies by size (number of employees)
- Appendix 3.2 - Companies by size/product group
  This appendix classifies the sample group into numbers of companies operating in 1,2,3,4,5,6, and 7+ product groups, i.e. least / most diversified

- Appendix 3.3 - Companies - percentages/product groups
  This appendix classifies the sample in the same way as appendix 3.2 but breaks the numbers down in terms of percentages of companies at the different size ranges operating in 1,2,3 etc. product groups
- Appendix 3.4 - Companies in 1 and 4+ product groups
  This appendix extracts from the main sample those companies operating in only one and more than four product groups and classifies them by number and product group.

The data presented in these appendices is the basis for the analyses and tabulations carried out below.

5. Data Analysis and Results

A. Diversification and Company Size

The data presented in Appendix 3.2 was first plotted to give a visual impression of the differentiation of company size by number of product groups in which firms were operating. The large spread of company size in the sample, from very small to giant company necessitated plotting the data on a logarithmic scale. This is presented in Figure 3.4 below.

Initial examination of the data showed that for all size ranges there were a large number of companies that were not diversified.

Figure 3.4 Percentage in 2+ Product Groups

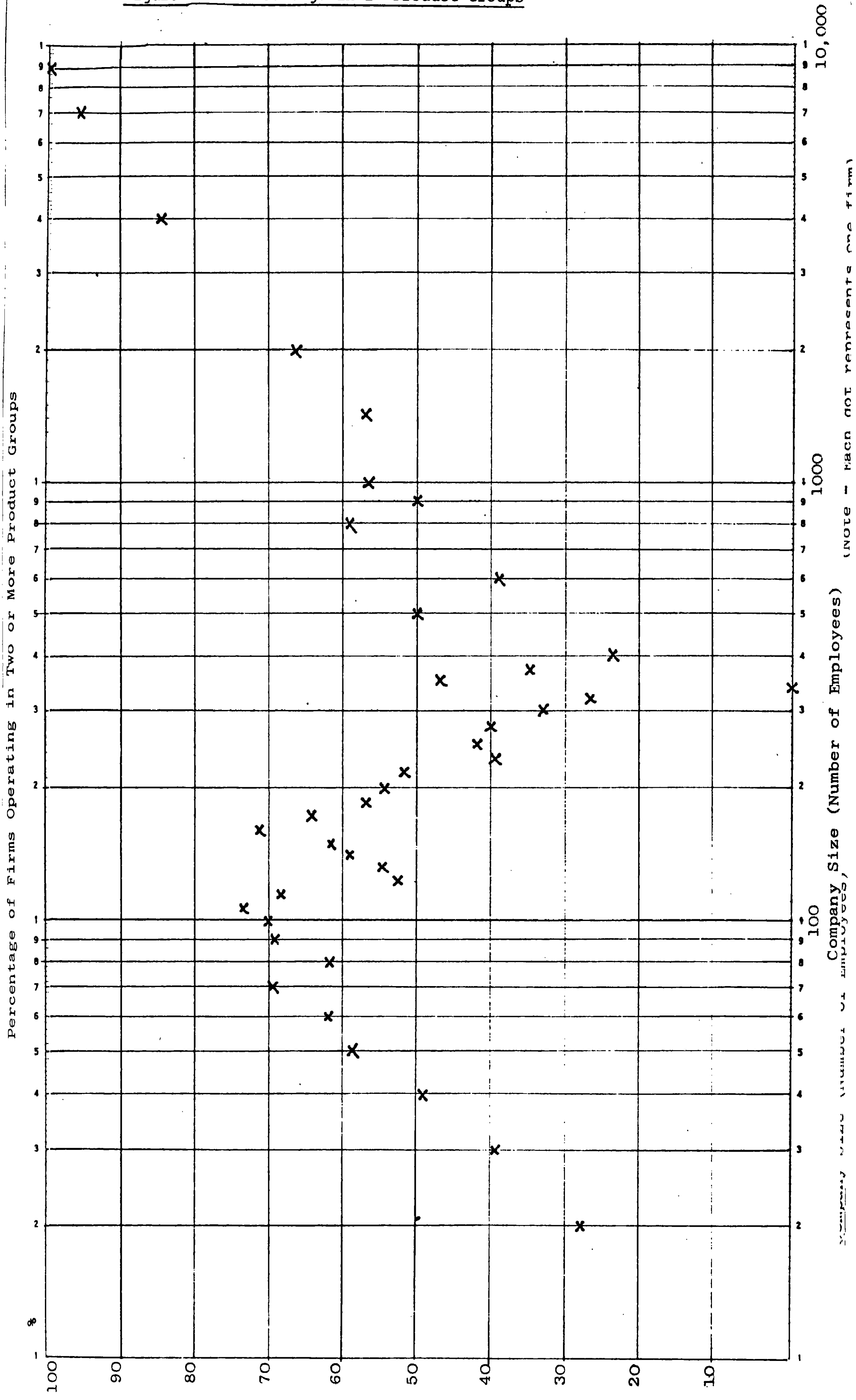


Figure 3.5 Percentage in 3+ Product Groups

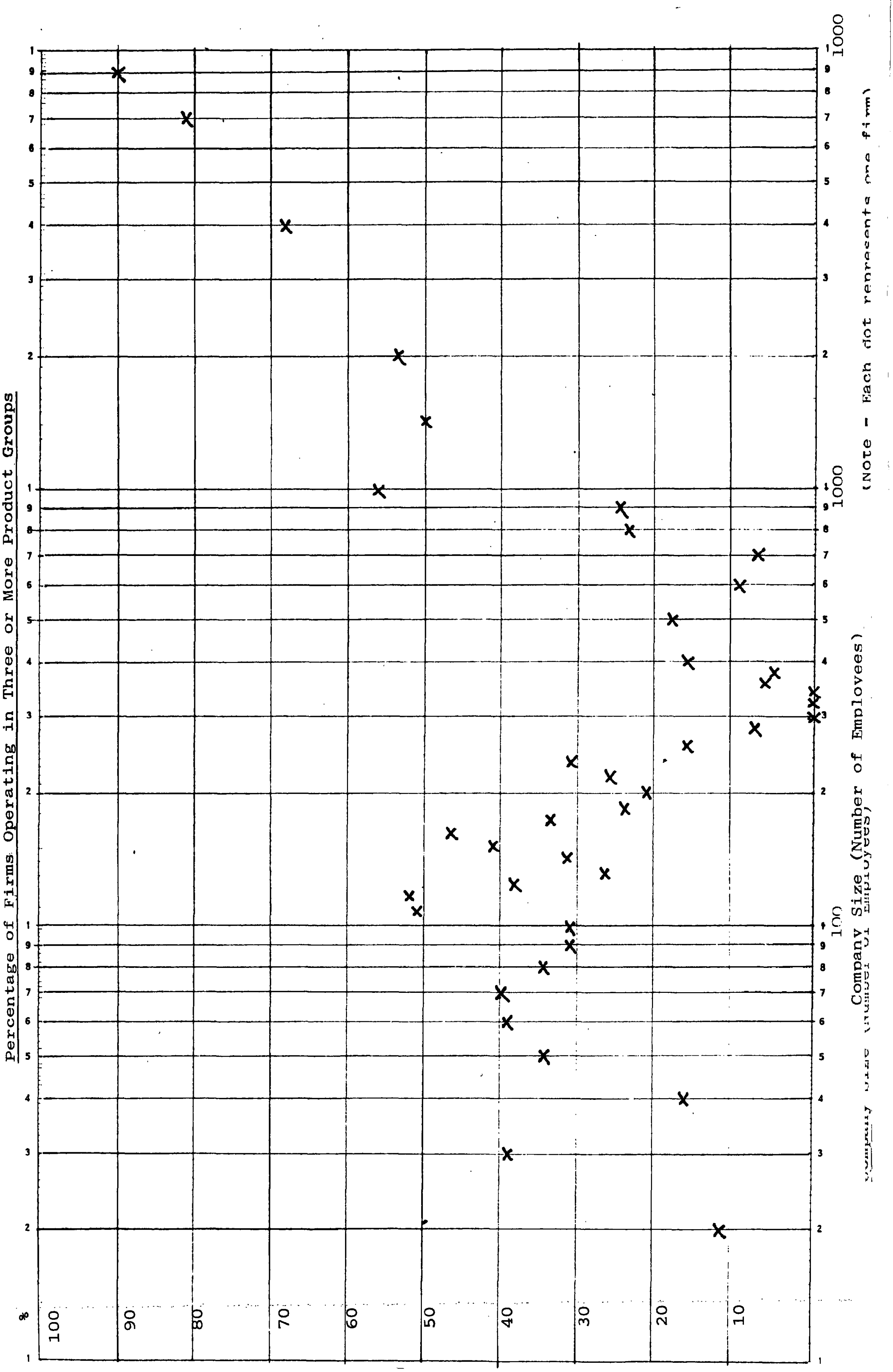


Figure 3.6 Firms operating in 1 - 7+ Groups

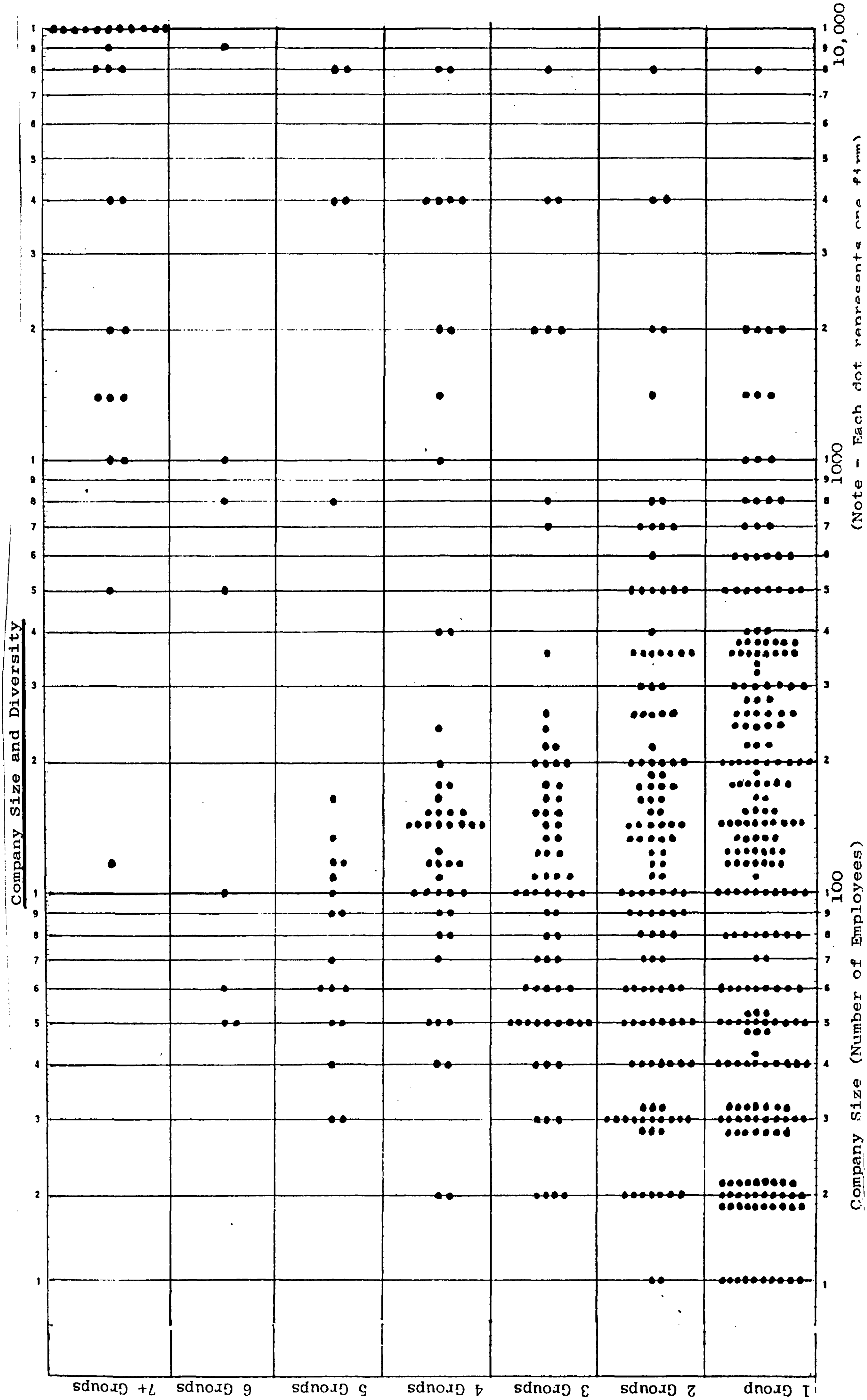


TABLE 3.4

2+ GROUPS - PERCENTAGE VS. NOS. EMPLOYEES

the regression equation is
y = - 284. + 201. x1 - 38.2 x2
+ 2.31 x3

	column	coefficient	st. dev. of coef.	t-ratio = coef/s.d.
	--	-284.	112.	-2.53
x1	c3	201.2	61.0	3.30
x2	c4	-38.2	10.6	-3.59
x3	c5	2.310	0.595	3.88

the st. dev. of y about regression line is
s = 14.3
with (39- 4) = 35 degrees of freedom

r-squared = 42.4 percent
r-squared = 37.5 percent, adjusted for d.f.

analysis of variance

due to	df	ss	ms=ss/df
regression	3	5267.	1756.
residual	35	7151.	204.
total	38	12417.	

further analysis of variance
ss explained by each variable when entered in the order given

due to	df	ss
regression	3	5267.
c3	1	454.
c4	1	1735.
c5	1	3078.

row	x1 c3	y c2	pred. y value	st.dev. pred. y	residual	st.res.
1	3.00	28.0	37.5	10.7	-9.5	-1.01 x
2	3.40	39.0	48.7	6.7	-9.7	-0.77 x
26	5.83	0.0	47.0	2.9	-47.0	-3.36r
38	8.29	84.0	72.2	7.0	11.8	0.95 x
39	8.99	95.0	112.4	12.6	-17.4	-2.58rx

r denotes an obs. with a large st. res.

x denotes an obs. whose x value gives it large influence.

--

X1 = log number of employees Log x
X2 = log number of employees squared $(\log x)^2$
X3 = log number of employees cubed $(\log x)^3$
Y = Percentage of firms operating in 2 or more product groups

3+ GROUPS - PERCENTAGE vs. NOS. EMPLOYEES

the regression equation is
y = - 236. + 161. x1 - 31.6 x2
+ 1.98 x3

	column	coefficient	st. dev. of coef.	t-ratio = coef/s.d.
	--	-236.	116.	-2.03
x1	c3	161.2	63.1	2.56
x2	c4	-31.6	11.0	-2.87
x3	c5	1.980	0.615	3.22

the st. dev. of y about regression line is
s = 14.8
with (39- 4) = 35 degrees of freedom

r-squared = 46.5 percent
r-squared = 41.9 percent, adjusted for d.f.

analysis of variance

due to	df	ss	ms=ss/df
regression	3	6633.	2211.
residual	35	7646.	218.
total	38	14279.	

further analysis of variance
ss explained by each variable when entered in the order given

due to	df	ss
regression	3	6633.
c3	1	1559.
c4	1	2811.
c5	1	2263.

row	x1 c3	y c2	pred. y value	st.dev. pred. y	residual	st.res.
1	3.00	11.0	16.8	11.1	-5.8	-0.59 x
2	3.40	13.0	24.9	7.0	-11.9	-0.92 x
35	6.91	57.0	23.2	4.8	33.8	2.42r
38	8.29	68.0	58.2	7.2	9.8	0.76 x
39	8.99	81.0	99.2	13.0	-18.2	-2.61rx

r denotes an obs. with a large st. res.

x denotes an obs. whose x value gives it large influence.

Note

X1 = log number of employees Log x
X2 = (log number of employees) squared $(\log x)^2$
X3 = (log number of employees) cubed $(\log x)^3$
Y = Percentage of firms operating in 3 or more product groups

However, this tended to obscure the fact that in particular size ranges the number of firms that were highly diversified varied substantially. It was considered that statistical analysis of the data would be obscured by the degree of 'noise', i.e. the random dispersion of non-diversified companies over all size ranges. Consequently it was considered that a more meaningful evaluation could be achieved by creating a statistic from the data taking account of this factor. By looking at the proportion of diversified firms (2 or more product groups, 3 or more product groups) existing in different size categories, it was possible to overcome this problem.

A problem with the way in which data is collected and aggregated (by Kompass) is that firms are classified to particular size groups (to the nearest ten employees for example). This leads to apparent peaks and troughs as can be seen in Appendix 3.3. Consequently it was necessary to use moving averages over two size intervals to remove fluctuations and more closely show the trend line. The results of this analysis are presented in Appendix 3.5 and plotted as Figures 3.5 and 3.6 below.

Interpretation of Results

Numbers of companies operating in 2+ and 3+ product groups and comprising the data in Appendix 3.5 were regressed against company size. Results of this analysis are prsented in Tables 3.4 and 3.5 below. As mentioned above, the key paramenters of regression equations are

(a) the coefficients of determination r^2 (or corrected for degrees of freedom $\bar{r}^2$)

(b) The coefficients of independent variables and the degree of confidence that we have that these are good predictors of the shape of the regression line, i.e. the respective t ratios (coefficients divided by their standard errors)

(c) Analysis of variance due to regression residuals, comprising the sums of squares of deviations.

The regression equation in cubic form gives a good explanation of the relationship between firm size (measured by numbers of employees) and the degree of diversification (measured by the proportions of firms operating in two or more and three or more product groups). Indeed the t ratios of the coefficients and the analysis of variance all yield very similar results at both 2+ and 3+ product group points. It is also significant to note that there is a better fit at the 3+ level than at the 2+ level. This is considered to be important because it seems reasonable that operation by firms in 3 or more product groups represents a commitment to much greater diversification than operation in two or more product groups.

If the coefficient of determination, in this case $\bar{r}^2$, is looked at, it can be seen that in both 2+ and 3+ cases, over 41% of the variation in the dependent variable (degree of diversification) can be explained by the size variables (numbers of employees). The cubic form was found to give significantly better results than either the quadratic or the quartic form of the equation. The increase in the coefficient of determination is not badly affected by the reduction in numbers of degrees of freedom occuring through the use of more independent variables.

However the coefficient of determination could have been affected by problems of multicollinearity. In this case, since the independent variables are based on the same statistic some degree of multicollinearity must be expected. This could increase the value of $\bar{r}^2$ even though movements in the independent variables were not good as explanations of the degree of variability in the dependent variable. However, in this case it can be seen that the t ratios are all in excess of $\pm$ 1.96 and are also of the same sign This would indicate that multicollinearity is not a serious problem here and has not artificially increased the coefficient of determination. An analysis of variance would also reinforce the hypothesis that the degree of variability of the data outside the predicted regression plane is relatively low.

Further analysis of the observations where the predicted and actual values are very different appears for the most part to be due to imperfections in the way the data was collected. As noted above, the Kompass data presentation rounds the statistic 'number of employees' to the nearest ten, with, in some cases further rounding to a larger value. This inevitably leads to a certain degree of distortion with numbers of companies 'grouped' into particular size bands.

In conclusion, the results presented here lead to the conclusion that the relationship between size and diversification very broadly fits the cubic form. The requisite regression parameters can be seen to be all consistent and stable.

B. Product Groups - Least and Most Diversified Firms

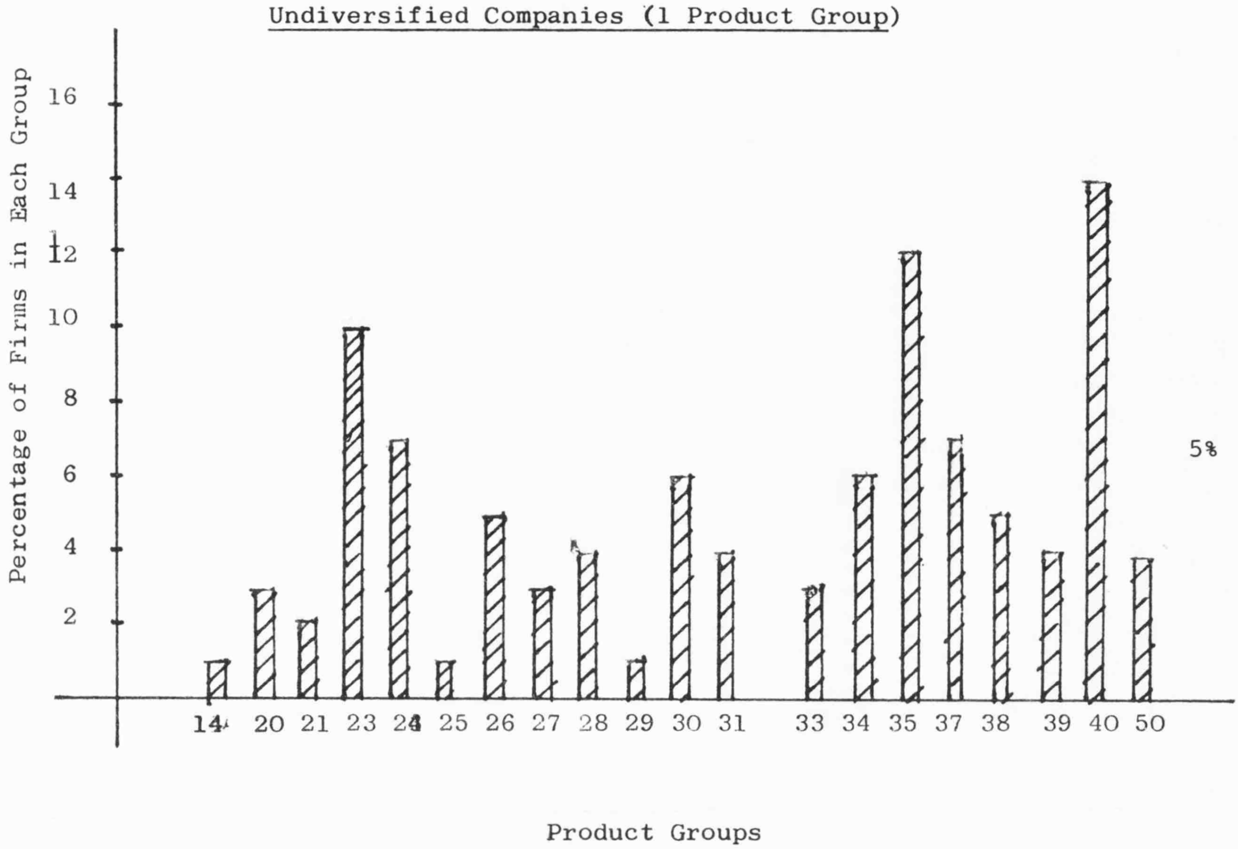
The objective of analysing product groups containing least and most diversified firms as described above was to define the industries, if any, where diversification appeared to be particularly prevalent and those in which it did not appear prevalent. The results of the analysis are presented in Appendix 3.4 in which the companies are classified by the product groups in which they are active.

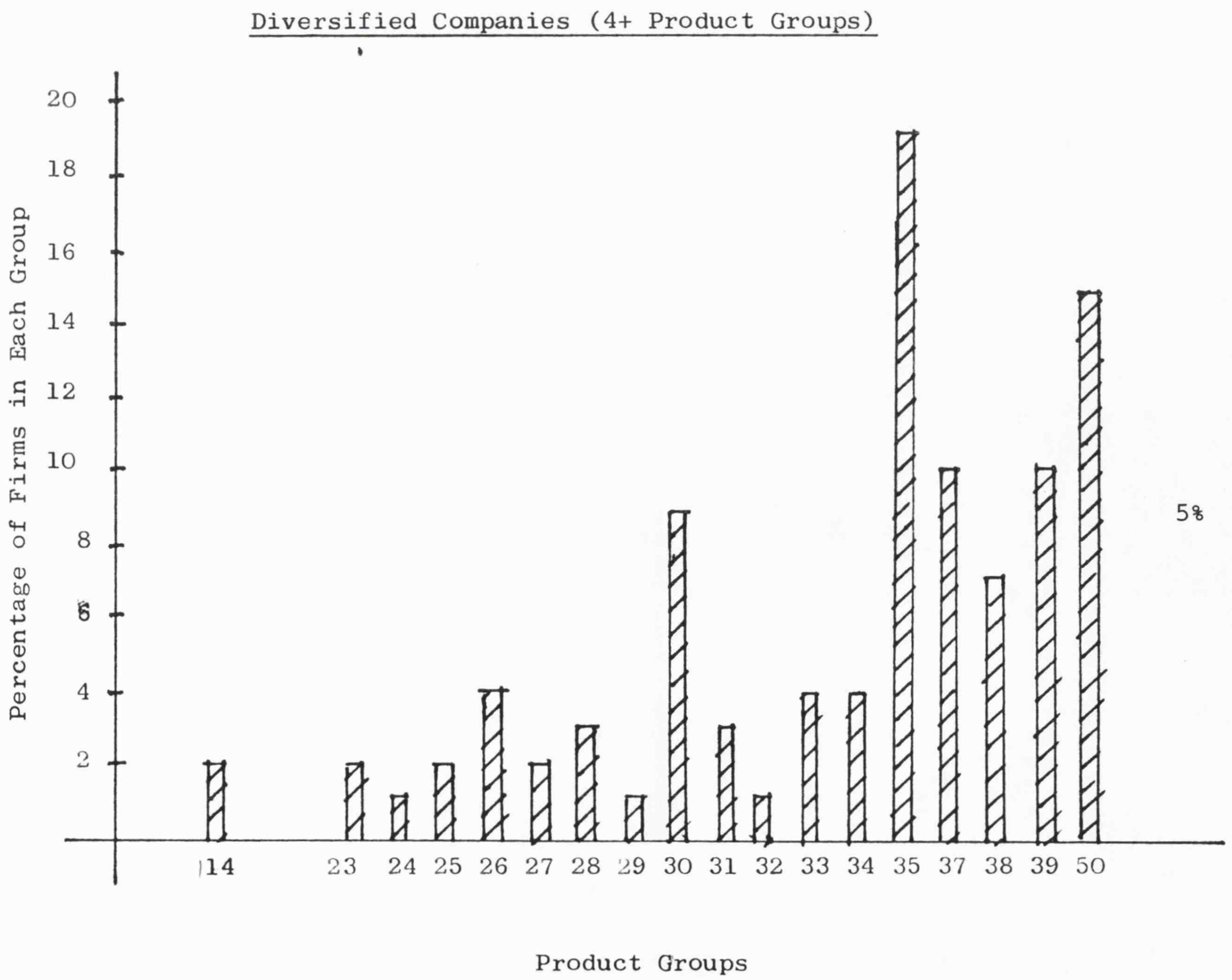
The data in Appendix 3.4 was plotted as the histogram below. Those industries in which more than five per cent of the sample were active were then tabulated as Table 3.6.

TABLE 3.6

Undiversified Groups (Kompass Product Group Classification)	Diversified Groups (Kompass Product Group Classification)
$\boxed{23}$	30
$\boxed{24}$	35
30	37
$\boxed{34}$	$\boxed{38}$
35	$\boxed{39}$
37	40
40	

Figure 3.7


Undiversified Companies (1 Product Group)
Percentage of Firms in Each Group
16
14
12
10
8
6
4
2
14 20 21 23 24 25 26 27 28 29 30 31 33 34 35 37 38 39 40 50
5%
Product Groups


Diversified Companies (4+ Product Groups)
Percentage of Firms in Each Group
20
18
16
14
12
10
8
6
4
2
14 23 24 25 26 27 28 29 30 31 32 33 34 35 37 38 39 50
5%
Product Groups

From these groupings, three types of industries can be identified:

(i) Type A which includes product Groups 23,24 and 34 where there are:-

Low numbers of diversifiers

High numbers of non-diversifiers

(ii) Type B which includes product groups 30,35, 37 and 40 where there are:-

High numbers of diversifiers

High numbers of non-diversifiers

(iii) Type C which includes product groups 38 and 39 where there are:-

High numbers of diversifiers

Low numbers of non-diversifiers

The product groupings are shown in Table 3.7

The three types of industries A,B and C can be analysed in several ways. Firstly, in terms of industry age, there would appear to be a correlation between Type A groups and age. All the groups in this type belong to the relatively 'old' technologies with a long history and where the pace of technological change may not be very high.

TABLE 3.7

Type A	Groups	23	- Textiles
		24	- Footwear and Clothing
		35	- Basic Metals
Type B	Groups	30	- Rubber & Plastics
		35	- Metal Products
		37	- Electrics and Electronics
		40	- Machinery and Equipment
Type C	Groups	38	- Transport Equipment
		39	- Scientific and Industrial Instruments

Type B contains industries which combine both new and traditional aspects, i.e. they span a wide age spectrum. The groups 'Machinery and Equipment' and 'Metal Products' which accounted for the largest individual percentages in both diversified and undiversified groups cover a particularly wide range.

Type C, covering transport and scientific and industrial equipment covers both Aerospace and the Car Industry, i.e. both 'new' and 'mature' industries, making aggregation more complex to analyse. However it is clear that both groups within the type are 'young' industries in comparison with type A.

By comparing the three types of industries with the intensity of Research and Development carried out, it is clear that there is a relationship between research intensity and diversification. While the industries in the first group have low research intensity the industries in the second and third groups have a much higher intensity. This would indicate that diversification and research intensity are correlated, and supports the results reported by Amey(1) in his study of the 1958 census of production figures and Hassid(2) in his study of the 1963 and 1968 figures. These researchers found that between one fifth and two thirds of the variation in the extent of diversification as measured by the ratio of secondary to total output could be 'explained' by variation in the technical personal ratio as suggested above.

Table 3.8 sets out the industry groupings by Research and Development expenditure.

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1. Amey, L R. op.cit

2. Hassid, J. (B). op.cit

TABLE 3.8

Research and Development Expenditure by Industry (1)

Type	Group Number	Industry	R&D as % of Sales	(2)
	23	Textiles	0.39	
I	24	Footwear & Clothing	0.04	
	34	Basic Metals	0.4	(3)
	30	Rubber and Plastics	1.31	(4)
II	35	Metal Products	0.27	
	37	Electrics/Electronics	3.80	
	40	Machinery & Equipment	0.87	
	38	Transport	3.56	(5)
III	39	Scientific and Industrial Instruments	1.58	

Notes:

1 Excludes Government funded R & D throughout

2 Figures from Business Monitor MO14 1978

3 Combines Ferrous/Non Ferrous Metals

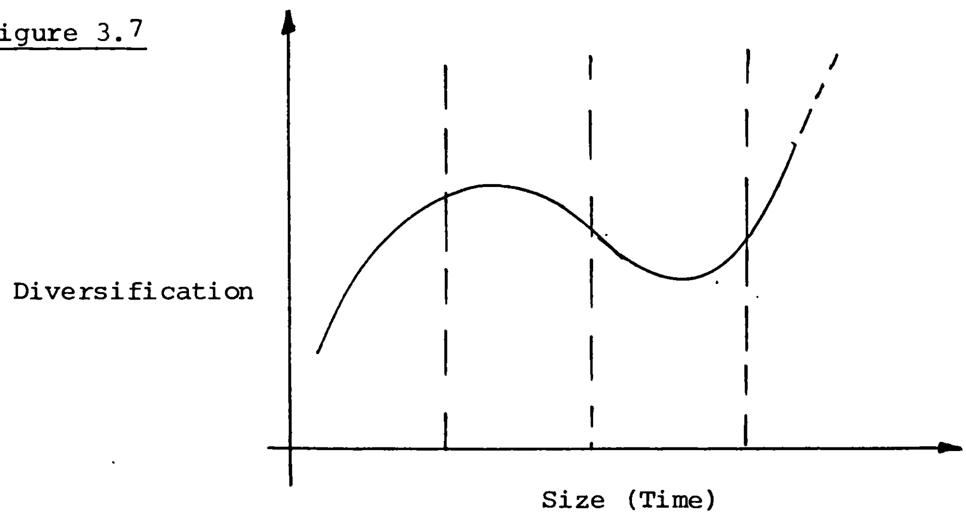
4 Includes man made/synthetic rubbers and plastics

5 Includes Aerospace and Vehicles

6. Postulations Based on the Results

The results suggest that there is a correlation between company size and the number of product groups in which individual firms operate. While the result tends to confirm on a macro scale (i.e. to 10,000 plus employee firms) that diversification increases with size, it also suggests that small companies between 80 and 200 employees show a relatively high degree of diversification as compared to both very small (less than 80 employees) and medium sized (200 - 1000 employees) companies. This would tend to support the theory suggested above that small firms may find it more easy to enter and leave markets in a flexible way, than larger firms which may have a greater investment in plant, machinery, stocks etc. If this proposal is correct it would tend to suggest that as company size increases (over, say, 150 employees), the degree of diversification may fall off. The study may, therefore also reflect the life history of the 'average' company (or aggregated company). This could be explained in terms of the plotted data on the graph (Figure 3.7).

Figure 3.7



In Section A, the company might start life as the result of entrepreneurial activities in one specific product, developing by diversification into new markets at an early stage. The costs of entering or leaving a market may be low at this stage since the scale of activities may be small and resources can probably be switched fairly rapidly from product to product, market to market. Investment in plant/machinery etc may be small and the success of the firm may depend more on marketing than production skills.

In Section B, the expansionary process (in terms of the number of product areas into which the firm has diversified) ceases as the skills and areas in which the firm is most successful become apparent. Technology licensing might be used at this point to increase the number of products in the area in which the firm intends to concentrate. Flexibility offered by this and other methods of product introduction may be important factors in the firm's concentration into particular product areas. At the same time, those of the diversified activities which have become peripheral may be dropped, while concentration on main activities continues and intensifies. The number of product groups in which the company is operating, falls, leading to the situation at 'C'.

In Section C which includes companies with more than 200 but less than 1000 employees, the capital intensiveness of the firm may increase as compared with its previous level. Each activity may account for a large proportion of the total activity of the firm.

Heavy investment in plant/machinery, training etc. may lead to a reluctance to enter new markets since the cost of obtaining a 'worthwhile' market share (synonymous with the share in the primary product group) may be high. As size increases, however, and market shares grow, further pressures to diversify may appear again from two directions. Firstly, further expansion within the market may become more difficult and secondly the ability of the company to raise funds may be enhanced (due to its greater size etc). At this point the diversification process may become more simple due to the firm's ability to buy whole ranges of products (as viable companies) rather than having to develop them 'in-house'. The 'costs' to the company, in management time, of purchasing a company may be relatively small, since the purchase will also transfer the purchased company's management to the purchasing company.

In Section D, the process described above may continue until at the end of the scale giant conglomerate companies are effectively operating as investors, rather than managers, with companies as the basic investment unit. This 'portfolio' effect was discussed above and can be seen in the case of some multinational firms where the parent company exercises financial rather than managerial control over operating units. The behaviour of the company at this stage may be likened to that of an investor who has diversified away as far as possible his unsystematic risk (i.e. that of concentration on one market(s)) leaving only the systematic risk (i.e. that of the failure of the whole system).[1] (Figure 3.8).

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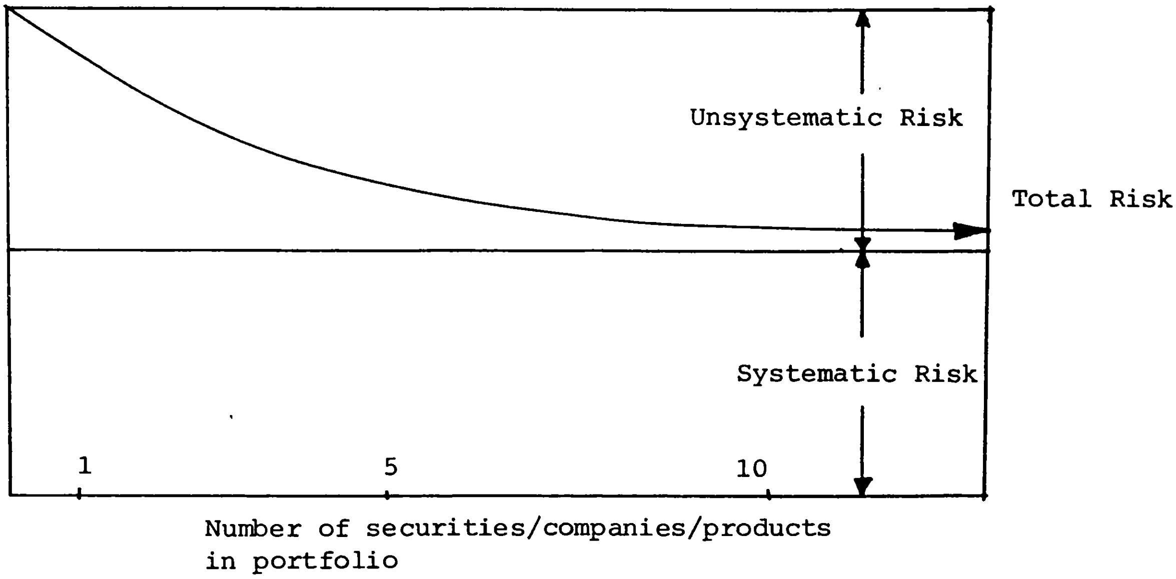
1. Weston, J F and Brighams, E F. op.cit.

Figure 3.8

Reduction of Risk Through Diversification



Source: Weston and Brighams op.cit

The diagram would suggest that further diversification beyond a certain point, in terms of numbers of products in a particular group, or total numbers of industries in which the firm is operating, will not further reduce risk levels. Too great a spread of activities may actually increase risk because of the lack of central or 'core' activities in which the firm is particularly skilled. The portfolio effect may well be important in reducing both the systematic and non-systematic risks that the company is running. From this point of view a varied portfolio of products would be an advantage. Within this product or 'activity' portfolio, methods of gauging the risks of new projects will also be relevant. This may be particularly important in the case of diversification. It is suggested that for each project, the risk/return equations, i.e. (greater risk - greater return) can be sub-divided into three types of risk. These can be defined as Research and Development, Production and Marketing Risk.

Briefly, the Research and Development risk-return line can be defined as a spectrum running from the low risk low potential return of 'applied' research such as product improvement, to the high risk high potential return of 'pure' research. Likewise, the Production risk return line can be defined as covering the spectrum from the present production competence of the firm, to areas where it has no skill and where production techniques are more complex than its present skill. The marketing risk-return line differs from the other two categories in that it may be more difficult to measure. The risk return line in this case can be defined as covering the range between the firm's present marketing competence and very different goods in different markets.

An analysis and study of risk under the three headings above comprises a separate section of this thesis.

E. CONCLUSIONS TO CHAPTER 3

The objectives of this chapter were to describe the theoretical framework for diversification, to review the existing studies that had been carried out into diversification, to identify those areas which had been adequately covered by researchers and to identify those other areas where the diversification process was not fully understood. The review suggested that there may be more work necessary before the complex nature and full scope of diversification in UK manufacturing industry is fully understood. It was clear that those researchers who had carried out work in the field had often been forced to use non-primary data in their studies. This had led to conflicting results being reported by different authors. The review also indicated a gap in diversification studies, namely, the small and medium sized firm sector. Few references to empirical work on the extent of diversification in small firms was found.

The study carried out during the investigation into small firms diversification suggested an apparent correlation between company size, as measured by numbers of employees and diversification measured by product groups in which the firms were operating. The relationship took the form of an S shaped curve rather than a linear relationship between size and diversification.(1) The S shaped curve could be divided into four sectors. Small firms,

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1. This result was also suggested by Hankinson, A. 'Investment Behaviour of smaller manufacturing companies' Unpublished Doctoral Thesis, Bath University, 1977

where the proportion of those diversified firms was rapidly increasing, small to medium sized firms where the proportion stabilised and began to decrease, medium to large firms where the proportion fell then began to rise and lastly large firms where the proportion of diversified firms increased to one hundred per cent. The suggested relationship between size and degree of diversification may be important in that it does not wholly confirm the work of earlier researchers in the field. While they found a direct relationship between increasing size and increasing diversity, these results would suggest that the relationship may be more complex.

Further analysis of the collected data indicated that diversification was more prevalent in small companies in certain industries, than in others. The figures suggested that a high research intensity provided a good guide to those industries in which diversification was likely to be important. While the scope of the study was not large it is suggested that the reported results may be important in a greater understanding of the degree to which (small) firms diversify.

APPENDICES TO CHAPTER 3

APPENDIX 3.1

NUMBERS OF FIRMS MAKING UP SAMPLE

Company Size (Employees)	Numbers of Firms
1 - 10	12
11 - 20	42
21 - 30	45
31 - 40	24
41 - 50	40
51 - 60	25
61 - 70	10
71 - 80	16
81 - 90	12
91 - 100	31
101 - 110	9
111 - 120	16
121 - 130	13
131 - 140	13
141 - 150	28
151 - 160	13
161 - 170	9
171 - 180	15
181 - 190	3
191 - 200	21
201 - 220	6
221 - 240	7

Company Size (Employees)	Numbers of Firms
241 - 260	12
261 - 280	3
281 - 300	10
301 - 320	1
321 - 340	0
341 - 360	16
361 - 380	7
381 - 400	6
401 - 500	16
501 - 600	7
601 - 700	8
701 - 800	9
801 - 900	0
901 - 1000	7
1001 - 1500	8
1501 - 2000	13
2001 - 4000	12
4001 - 8000	10
8001 - 12000	10
12001+	11
Total Firms in Sample	569

FIRMS CLASSIFIED BY NUMBERS OF PRODUCT GROUPS IN WHICH THEY OPERATE

Nos. Employees	1 Gp	2 Gp	3 Gp	4 Gp	5 Gp	6 Gp	7 Gp+	Total Firms
0 - 10	10	2	-	-	-	-	-	12
11 - 20	29	7	4	2	-	-	-	42
21 - 30	24	16	3	-	2	-	-	45
31 - 40	11	7	3	2	1	-	-	24
41 - 50	16	8	9	3	2	2	-	40
51 - 60	9	7	5	-	3	1	-	25
61 - 70	2	3	3	1	1	-	-	10
71 - 80	8	4	2	2	-	-	-	16
81 - 90	-	6	2	2	2	-	-	12
91 - 100	10	7	7	5	1	1	-	31
101 - 110	1	2	4	1	1	-	-	9
111 - 120	7	2	-	4	2	-	1	16
121 - 130	7	2	3	1	-	-	-	13
131 - 140	5	5	2	-	1	-	-	13
141 - 150	12	6	2	8	-	-	-	28
151 - 160	4	2	3	4	-	-	-	13
161 - 170	2	3	2	1	1	-	-	9
171 - 180	7	4	2	2	-	-	-	15
181 - 190	1	2	-	-	-	-	-	21
191 - 200	10	6	4	1	-	-	-	21
201 - 220	3	1	2	-	-	-	-	6
221 - 240	5	-	1	1	-	-	-	7
241 - 260	6	5	1	-	-	-	-	12
261 - 280	3	-	-	-	-	-	-	3
281 - 300	7	3	-	-	-	-	-	10
301 - 320	1	-	-	-	-	-	-	1
321 - 340	1	-	-	-	-	-	-	1
341 - 360	8	7	1	-	-	-	-	16
361 - 380	7	-	-	-	-	-	-	7
381 - 400	3	1	-	2	-	-	-	6
401 - 500	8	6	-	-	-	1	1	16
501 - 600	6	1	-	-	-	-	-	7
601 - 700	3	4	1	-	-	-	-	8
701 - 800	4	2	1	-	1	1	-	9
801 - 900	-	-	-	-	-	-	-	0
901 - 1000	3	-	-	1	-	1	2	7
1001 - 1500	3	1	-	1	-	-	3	8
1501 - 2K	4	2	3	2	-	-	2	13
2.1K - 4K	-	2	2	4	2	-	2	12
4.1K - 8K	1	1	1	2	2	-	3	10
8.1K - 12K	-	1	-	-	-	1	1	3
12.1K+	-	-	-	-	-	-	11	11
Totals	250	138	73	52	22	8	26	569

APPENDIX 3.3

PERCENTAGE OF FIRMS OPERATING IN VARIOUS PRODUCT GROUPS

Company Size (Employers)	Percentage of Firms Operating In One Product Group	Two or More Product Groups	Three or More Product Groups
0 - 10	83	17	0
11 - 20	69	31	14
21 - 30	53	47	11
31 - 40	46	54	25
41 - 50	40	60	43
51 - 60	36	64	36
61 - 70	20	80	47
71 - 80	50	50	25
81 - 90	0	100	50
91 - 100	32	68	45
101 - 110	11	89	67
111 - 120	44	57	45
121 - 130	54	46	30
131 - 140	38	61	23
141 - 150	43	62	23
151 - 160	31	69	54
161 - 170	23	77	44
171 - 180	47	53	26
181 - 190	33	67	0
191 - 200	47	53	25
201 - 220	50	50	33
221 - 240	71	29	29
241 - 260	50	50	8
261 - 280	100	0	0
281 - 300	70	30	0
301 - 320	100	0	0
321 - 340	100	0	0
341 - 360	50	50	8
361 - 380	100	0	0
381 - 400	50	50	33
401 - 500	50	50	12
501 - 600	85	15	0
601 - 700	38	62	12
701 - 800	44	56	33
801 - 900	0	0	0
901 - 1000	43	57	57
1001 - 1500	38	62	50
1501 - 2000	31	69	54
2001 - 4000	0	100	83
4001 - 8000	10	90	90
8001 - 12000	0	100	67
12001+	0	100	100

APPENDIX 3.4

FIRMS OPERATING IN 1 AND 4+ PRODUCT GROUPS

Product Group Classification		Firms Operating in 1 Product Group		Firms Operating in 4+ Product Groups	
Kompass No.	Description	No.	Percentage of Total	No.	Percentage of Total
14	Mining	2	1	-	2
20	Agriculture/Food	7	3	-	-
21	Beverages	4	2	-	-
23	Textiles	24	10	4	2
24	Footwear/Clothing	17	7	3	1
25	Wood	2	1	6	2
26	Furniture/Fittings	12	5	10	4
27	Paper & Board	8	3	6	2
28	Printing/Publishing	11	4	7	3
29	Leather & Fur	3	1	1	1
30	Rubber & Plastics	14	6	21	9
31	Chemicals	10	4	7	3
32	Petroleum & Coal	-	-	2	1
33	Non Metallic Minerals	7	3	11	4
34	Basic Metals	15	6	10	4
35	Metal Products	30	12	45	19
37	Electrical Equipment	18	7	25	10
38	Transport Equipment	12	5	16	7
39	Scientific Instruments	9	4	24	10
40	Machinery & Equipment	36	14	37	15
50	Construction Supplies	9	4	-	-
	Totals	250*	-	242**	

*Total of 250 companies
**Total of 82 companies classified into 242 product groups

APPENDIX 3.5

MOVING AVERAGES OF PERCENTAGE OF FIRMS

OPERATING IN VARIOUS PRODUCT GROUPS

Company Size (Employees)	Percentage of Firms Operating in One Product Group	Two or More Product Groups	Three or More Product Groups
0 - 20	72	28	11
11 - 30	61	39	39
21 - 40	51	49	16
31 - 50	42	58	35
41 - 60	38	62	39
51 - 70	31	69	40
61 - 80	38	62	35
71 - 90	31	69	31
81 - 100	30	70	31
91 - 110	27	73	51
101 - 120	32	68	52
111 - 130	48	52	38
121 - 140	46	54	27
131 - 150	41	49	32
141 - 160	39	61	41
151 - 170	29	71	47
161 - 180	37	63	34
171 - 190	44	56	23
181 - 200	46	54	21
191 - 220	48	52	26
201 - 240	61	39	31
221 - 260	58	42	16
241 - 280	60	40	7
261 - 300	77	23	0
281 - 320	73	27	0
301 - 340	100	0	0
321 - 360	53	47	6
341 - 380	65	35	5
361 - 400	76	24	16
381 - 500	50	50	18
401 - 600	61	39	9
501 - 700	60	40	7
601 - 800	41	59	24
701 - 900	50	50	25
801 - 1000	43	57	57
901 - 1500	43	57	50
1001 - 2000	33	67	53
1501 - 4000	16	84	68
2001 - 8000	5	95	81
4001 - 12000	0	100	82
8001 - 20000	0	100	93

CHAPTER 4

TECHNOLOGICAL CHANGE, INNOVATION AND NEW PRODUCT DEVELOPMENT IN SMALL FIRMS

A. INTRODUCTION

'Technology' is a term that is probably particularly difficult to define. In its widest sense it can be used in an all embracing sense to cover all knowledge that is utilised in the production of goods and services.[1] In the context of this thesis a definition of technology is important because of the wide variety of information that can be transferred under licence agreements, whether these comprise patented products or processes, 'know-how' or the right to use a particular trade name or industrial design.[2]

The methods by which smaller firms generate and utilise 'technology' are likely to be important in consideration of such firms' propensity to utilise the transfer of technology under licence. In this context it is suggested that smaller firms may have an important role to play in stimulating the use of new technological processes even if they do not possess the resources to bring those processes to fruition in every case.[3] It is probably important therefore

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1. 'Technology' (Science of) - Practical or industrial art Concise Oxford English Dictionary. 1982

2. Technology is therefore used here in its widest sense to cover science, the engineering required to translate scientific advance into new products, the design process necessary to make those products attractive to consumers and the application of those products by consumers.

3. See for example Advisory Committee on Applied Research and Development. 'Industrial Innovation', HMSO, 1978

to differentiate between embodied and unembodied 'technology' in the context of technology transfer under licence. In the case of 'embodied' technology, the 'technology' can be considered as part of a machine or other piece of equipment. While the technology that is the basis of that machine may be relocated from the manufacturer to the buyer and hence the technology is transferred, this is not usually considered to comprise technology transfer as it is defined here. Transfer of embodied technology probably does not usually confer upon the buyer any ability to re-use that technology beyond its function within the equipment in which it is embodied.

Unembodied technology however, is considered to comprise any intellectual property that can be described and transferred as a concept or set of instructions. This transfer may confer upon the buyer the ability to use the technology for his own purposes, whether that be as process technology in producing goods with the information transferred or embodying it within his own products. This is probably an important differentiation, since it is usually the latter category of technology that is transferred under licence. One case in which embodied technology could be considered to comprise part of a licence agreement however, might be where a machine is provided by the seller of the technology such that the buyer may utilise it to exploit a process (i.e. unembodied technology) which the seller is making available to the buyer under licence.

The objective of this short chapter is to define technological change and the transfer of new technologies arising as a result of that change in the context of the small firm, and to relate it to the major subjects of this thesis, diversification and technology licensing. It is considered important to define technology and its diffusion separately from the issue of innovation in the smaller firm. It is probably valid to separate a classification of technology, and the development of strategies for exploitation of a technology portfolio. This chapter, therefore, considers the potential sources of 'technology', its development and diffusion, and its application through the various stages of the 'technology life cycle'.[1]

Exploration is made of the technological environment of the small firm in conjunction with consideration of the more practical aspects of innovation and new product development in smaller firms. It is the objective of the chapter to place the utilisation of technology in smaller firms in the context of their use of licensed or bought in intellectual property. In the context of the case study approach comprising a major part of the empirical work in this thesis, definition of precisely what 'technology' may be involved in transfer under licence is considered important. The potential sources of 'technology', its management and exploitation, is therefore considered below.

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1. Ford, D. 'Taking Technology to Market'. Harvard Business Review, March/April 1981

B. TECHNOLOGY SOURCES AND RESOURCES

1. The Technology Life Cycle

Consideration of the development processes of new technology suggests a parallel process in some respects to the product life cycle concept.[1] This might suggest a multiple stage process. Tisdell[2] for example, defines four stages in the life cycle of a technology, namely invention, innovation, diffusion and replacement. It is probably useful therefore to consider the differences between 'invention' and 'innovation' and to explore how the processes of diffusion and replacement might come about. While invention is defined as "the creation of an idea or concept", innovation is "the use of that idea or concept in the production of new goods or services."[2] 'Innovation' therefore, probably

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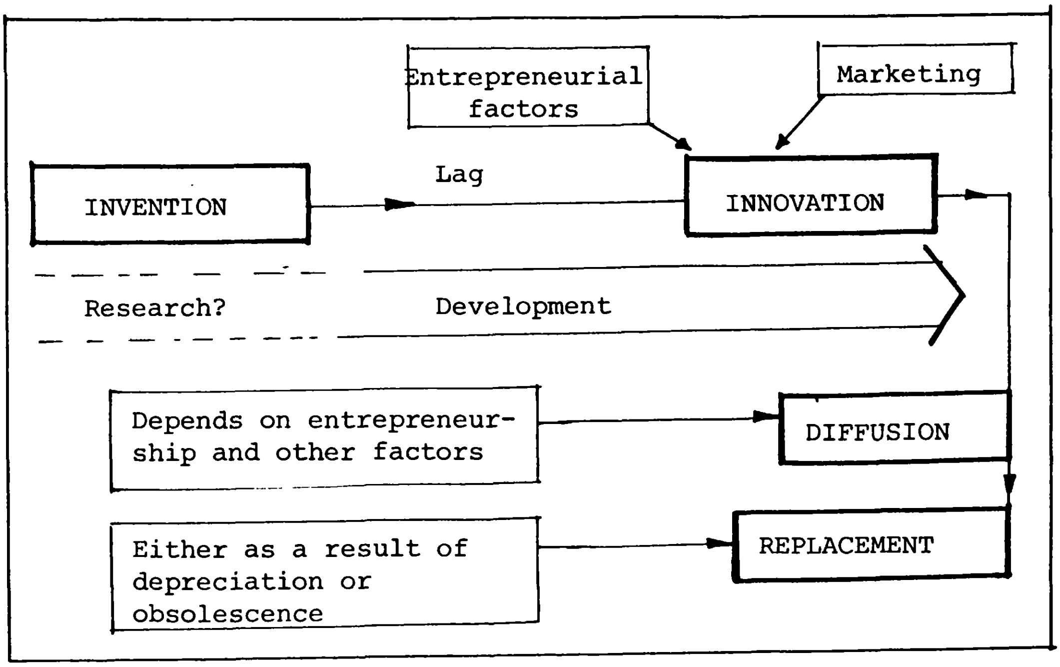
1. Explored in more detail in Chapter 2.

2. Tisdell, C.A. 'Science and Technology Policy', Chapman and Hall, London, 1981



comprises the more practical aspects of new product development, and this is discussed in more depth below.

It is the objective of this chapter to try to define technology in terms of how the smaller firm might manage exploitation of its technology most effectively. The technological environment of many smaller firms may in any case be different from that in some larger firms operating monopolistically in particular markets, and able in part to control the direction of technological development by applying resources in a particular way. It is suggested that most small firms probably have a much smaller control over their technological environment than such larger concerns.

'Invention' suggests the conceptualisation of new ideas for products and processes which may not require the expenditure of large resources in their definition. However, the 'prospective utility'[1] of an idea may have little commercial value until the process of innovation has been completed and that idea translated into a commercially viable product. Since smaller firms clearly have less resources in total than larger firms, it may be for this reason that such firms are frequently considered to be good inventors, but less successful innovators.[2] A larger firm may be more willing to support relatively speculative innovatory activities with the long term objective of improving

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1. Tisdell, C.A. op.cit.

2. Bolton, J.E. Committee of Enquiry on Small Firms, HMSO, 1971

technology portfolios while most smaller firms might be unable or unwilling to commit resources to this process.[1] Many small firms might therefore be anticipated to consider alternative methods of exploiting their inventions as well as through the development of new products or processes, particularly if that technology did not conform to current product portfolios. Sale of such technology under licensing or other agreements could be one method by which this could be achieved.

The concept of 'diffusion' or the pressure on a technology to be transferred from company to company and country to country is an important issue in this thesis, since licensing is one method by which diffusion can take place. The diffusion process is probably subject to many forces including a requirement by end users for more efficient production processes, and competitive pressures. These are discussed at greater length below. However, it is probably also important to consider how rates of diffusion could be governed not only by the advantages of that technology over current technology, but also by the requirements of potential recipients.[2]

Replacement, the last stage in the technological life cycle as defined above, is considered to describe the process whereby new techniques supersede older technologies. Replacement however

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1. A distinction might be made here between 'pure' and 'applied' research.

2. Thus companies with high investment in current technologies might be less likely to seek out new more competitive technology than companies with no existing capital investment of this type.

may proceed at different rates in different markets. Technology that is obsolescent or obsolete in one market or country may have a useful life in another market or country,[1] particularly where this market is 'protected' in some way.[2] Replacement is likely to be a continuous, long term process, rather than an immediate change, unless developments in technology give such a great advantage that production using the old technology becomes uncompetitive.[3]

2. Sources and Development of Technology

The literature describing potential sources, and suggesting development theories of technology is voluminous and detailed. Particular works can probably be defined as keynote articles.[4] However, empirical studies relating to actual innovational activity

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1. Thus many licensing agreements concern the transfer of labour intensive or 'uneconomic' technologies into low labour cost markets.

2. i.e. through tariff barriers on other market distorting mechanisms. Such barriers can clearly provide opportunities for out-licensing 'older' technologies to such markets.

3. Tisdell, C.A. op.cit. see also the Pilkington case reported in Chapter Five.

4. See for example, Jewkes, Sawyers and Stillerman. 'The Sources of Invention' London. Macmillan

appear to be less frequently available.(1) The reasons for this may include the difficulty, noted above, of measuring 'technology' in any meaningful manner and of defining closely enough any particular innovation, in order to measure its development and diffusion.

Sources of technology can probably be sub-divided into four parts: individuals; small companies; large companies; and governmental, quasi governmental and other sources. Clearly there may be many methods for smaller firms to exploit such sources of technology from outside the firm to complement any policy of 'in-house' development. In the context of this thesis it is probably important therefore to consider how effective each of these sources may be in the development of new technology, and how such sources may be exploited as a source of licensed products for smaller firms.

Role of Individuals

Historically, individuals appear to have been very important in developing and 'championing' new technologies.(2) Although individuals probably do still have a part to play in such

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1. Boylan, M.G. 'The Sources of Technological Innovations' in 'Research, Technological Change and Economic Analysis', Ed. Bela Gold, Published Lexington Books, 1977

Boylan suggests that:- 'Generally, studies relating to actual innovational activities are relatively few, often based on very small samples of data, and offering results that are frequently in conflict."

2. See for example, Jewkes, J Sawyers, D and Stillerman, R. op.cit.

developments in many cases, the proportion of new developments attributable to them has, since 1930 at the latest, undergone a sharp decline.[1] This phenomenon is probably linked to expenditure, since the costs of research and development leading to major new technologies has markedly increased over this period as technological complexity has grown.

As an external source for new technology, individual 'inventors' probably are not usually a suitable source of new technology for smaller firms. While larger firms may have the resources to evaluate and if necessary develop new ideas submitted in prototype or conceptual form by individuals, smaller firms may have less resources to commit to such processes.[2] Many inventors may under estimate the amount of development work involved in commercialising their ideas and may be reluctant to abrogate control over their product/project to others.
Individuals may however be more important in developing industrial <u>design</u> expertise and it is perhaps relevant to note that most industrial design consultancies are <u>small</u> firms which appear to have developed around the skills of one gifted individual.

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1. Tisdell, C.A. op.cit.
2. Freeman, C. <u>'The Economics of Industrial Innovation'</u> Penguin, 1974

Role of Small Firms

Small firms do appear to produce a larger proportion of new inventions than their size would seem to warrant.(1) This may be important in view of empirical evidence that most small manufacturing companies carry out very little research and development (R & D) work.(2) However, in view of the lower task differentiation in such firms, such evidence should probably be viewed with a degree of caution and it seems possible that many smaller firms claiming to carry out no 'R & D' do carry out some product development work short of research.

While small firms have been suggested to be good inventors, their role in innovation may not be so successful. High cost development of new technology may not be an attractive option to smaller firms, even if the technology under consideration has a high chance of success. The opportunity cost of developing such technology may be too high for successful product implementation. Such considerations might be anticipated to increase the propensity of smaller firms to license part developed technology 'out' to larger concerns, for further development and market launch. However, such views may be somewhat simplistic in light of the empirical evidence available on the interaction between large and small firms

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1. Bolton report. op.cit.

2. Rothwell R and Zegveld W. 'The Role of Small Manufacturing Enterprises in Innovation'. Frances Pinter, 1982

in developing, exploiting, and diffusing new technology.[1] Smaller firms may exploit either comparative or absolute advantage[2] in exploiting small market segments because of their closeness to the markets concerned which may enable them to identify and act quickly to fulfil market needs. This might suggest that the extent of formal or informal collaboration between small and large firms could be an important factor in the rate of technology diffùsion, and the exploitation of such market segments.

Role of Large Firms

Large firms probably account for a majority of the R & D expenditure in the 'advanced' countries.[3] Much of this expenditure may lead to developments which for strategic or marketing reasons may not be commercialised. Some larger firms may therefore be considered as a potential source of unused or under-exploited technology and might therefore appear to be a potential source of technology for smaller firms to exploit.

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1. Rothwell, R. 'The Role of Small Firms in the Emergence of New Technologies' OMEGA, Vol.12, No.1. 1984

Rothwell suggests that a much more dynamic and interrelated process occurs with small firms acting to incorporate and utilise the results of research by larger companies and developing markets for the innovations concerned in many cases.

2. As discussed in Chapter Two.

3. Rothwell R and Zegveld W. op.cit. suggested that large firms (5000+ employees) accounted for 60% of R & D expenditure in the 'advanced' countries.

Smaller firms might find exploitation of small market segments utilising such purchased technology to be feasible propositions. However, in view of the transaction costs involved, some larger firms might find the option of transferring technology to smaller firms through licence or other agreements to be problematical and unattractive alternatives. Exploitation of embodied technology however,[1] or in the development of 'add-on' products[2] to products produced by larger firms could provide a means for effective joint exploitation by large and small firms around a 'core' technological expertise.

Development and diffusion of new technologies may therefore consist of an interrelated process involving both large and small firms in many cases. This might suggest a 'cascade' approach in which larger concerns developed a base technology for a particular purpose but where smaller firms then developed further applications for the technology and extended its utilisation into new markets .

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1. As for example in developing applications around micro-processors or for plastic products around new plastics *per se*.

2. As for example in the development of 'plug compatible' products for IBM micro-computers, such as printers and interface units.

The Role of Government and Quasi Government Bodies

Government and quasi government bodies are also responsible for a substantial proportion of R & D expenditure in Great Britain.[1] While a majority of such expenditure can be allocated to defence and defence related areas, the public utilities, government research organisations and the Universities etc. all contribute to the national fund of technology through utilisation of public funds. Small firms can benefit from such research through licensing 'in', and by joint ventures with such bodies as British Technology Group in some cases. In a majority of instances however, government organisations do not appear to have been highly proactive in their sale of technology to small firms.[2] Many smaller firms may not be aware of the opportunities available from 'public sources' in this way. However some Governmental and Transnational organisations have recently commenced initiatives in an endeavour to correct this apparent market failure.[3]

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1. Business Monitor, 'Industrial Research and Development Expenditure and Employment', MO14 Business Statistics Office 1978.

Government expenditure	29%	1978
Finance by Government of R & D expenditure in private industry	32%	1978

2. Bowler, J.E. in 'Technology Licensing and the Small Firm' Lowe J and Crawford N (eds). Gower Press, 1984

3. See Appendix 4.1'Grants From Europe for Small Firms' The measures under 'Licensing Initiatives' have recently been set up by the Department of Trade and Industry. Work resulting from the 'Leverhulme' study reported in Chapter 6 was used in this programme.

3. Diffusion of Technology

Diffusion of technology can probably take place through both formal and informal channels. In the context of this thesis, informal diffusion is used to describe the transfer of knowledge through public media while formal diffusion is used to describe the transfer of technology through the movement of people or equipment. As suggested above, 'technology' can be embodied in machinery or comprise designs, techniques or other less definable concepts.(1)

Smaller firms may have an important role to play in the process of technological diffusion in acting to take advantage of new techniques. It is suggested that many 'start-up' companies may be the result of technology diffusing from a larger company where an individual within that company has been unable to gain acceptance for his idea within the larger firm, and hence sets up his own organisation to exploit that idea. In this context it is valid to consider what pressures might impinge upon the diffusion process, the development of that process, and any barriers that might lead to a reduction in the diffusion of technology *per se*.

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1. See also Teece, D.J. 'Technology Transfer by Multinational Firms.' The Economic Journal, June 1977

Pressures Towards Diffusion

Clearly technology does not diffuse without an impetus, but rather as the result of specific pressures which might include economic, technical or sociological pressures. Historical communication barriers to the dissemination of information on new technological developments have probably been largely eliminated within particular cultural groups (by radio/television/jet flight etc.)[1] However, improved communications informing potential recipients of new technologies, will probably give no impetus to their diffusion unless an economic rationale also exists.[2] Where the economic rationale is low therefore, the pressure towards diffusion may therefore be weaker and the balance of 'user pull' to 'technology push' may change leading to a slower diffusion of that technology.

'User pull' describes a situation where potential users of a technology or a product recognise the benefits of that technology and attempt to obtain it. Pressures towards 'user pull' may arise through the demonstrated benefits of the new technology and its potential as a competitive weapon or as a result of other pressures arising as internal or external trigger signals within the firm. Such pressures could arise through strategic decisions

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1. Barriers of communication between different language and cultural groups clearly still do exist however, although such barriers may not be as powerful as hitherto.

2. Although since the amount of information available has also increased, the difficulty in actually identifying technology suitable for local exploitation may have increased in some cases.

to diversify into new areas, competition from rivals or the increasing obsolescence of products within the company's product portfolio. In the case of the smaller firm, user pull may be an important pressure towards the transfer of intellectual property under licence agreements. In such instances, inward licensing might be perceived in some cases as a potential method of overcoming a short term product requirement without necessitating costly and time consuming research and development programmes 'in-house'.

'Technology push', an alternative pressure towards the diffusion of a technology, may occur when a new technology can be demonstrated to be so superior to currently available techniques that companies are forced to use it or risk being overcome by competitors utilising the new techniques. This would suggest that the more superior is the technological advance, the faster will be its diffusion. However, even in those cases where a new technology is demonstrably superior to current techniques, its rate of diffusion may be reduced by the reluctance of some companies with high investment in current technologies to re-equip with the new technology. This might suggest that in some cases new companies entering the market might have an advantage in being able to utilise immediately the new technology, and benefit from lower production costs inherent in its use.

Diffusion may not always occur even in cases where both user pull and technology push effects are apparent. The reasons for this may be several.[1] In the context of an exploration of behavioural factors impinging upon technology diffusion, ignorance of new techniques and managerial inertia may be important factors in the use or non-use of technology licensing to obtain new techniques. In terms of the strategic objectives of the smaller firm, an effectively functioning information system to highlight new relevant technologies within the current market, and within markets likely to impinge upon current activities, would seem to be important.

<u>Process of Diffusion</u>

Clearly a variety of alternatives are likely to exist for the effective diffusion of both embodied and un-embodied technology. These may include contractual transfer or acquisition of intellectual property, non-contractual transfer and the movement of personnel.

Acquisition or contractual transfer of technology may encompass a spectrum of activities including the purchase of technology embodied in goods, in machinery to make those goods, licensing agreements to purchase intellectual property and acquisition of

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1. Tisdell, C.A. op.cit. suggests:

    (a) ignorance or lack of knowledge about the availability of the new technique
    (b) managerial inertia (sleeping managers)
    (c) uncertainty about future demand for products to be produced using the technique
    (d) technological uncertainty
    (e) labour fears and trade union resistance

companies utilising a particular technology.[1] In many cases however, diffusion may arise as a process of imitation rather than through contractual or other formal means of diffusion. Within this process, information may be transferred as a result of publicity in free sources such as published information. Information obtained from 'free' sources may be sufficient in some cases for the firm to imitate the product directly and, in the case of patented information to design around the patent.[2] However, information of this sort may be supported by the movement of personnel and the latter may indeed be one of the most important methods of diffusion of technology.[3] Non-contractual transfer may be particularly important where non-patented technology is involved and it is in this case that the movement of personnel may be particularly important in diffusing technological skills.[4]

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1. An exploration of alternative strategies for obtaining new technology in practice is made in Chapter 5.

2. Clearly one method of copying already existing (particularly non-patented) technology is to recruit personnel from the original intellectual property holder.

3. Although imitation or copying of a product is clearly one method whereby technology is diffused, for the imitating firm, contractual transfer of technology (i.e. by taking a licence) may often be cheaper than attempting to copy a technology. There is also some evidence (presented later) that some licences are agreed to by licensor firms under duress, i.e. by the threat of imitative behaviour. On the other hand, in some industries (e.g. toys) the response of firms to pressures of imitation is to licence widely at an early stage in the product life cycle, to maximise returns on that technology.

4. In 1975 the author was employed in the largest replacement window and door company in the UK. This company had been founded when a group of managers left a competitor company to start their own business.

Barriers to Diffusion

While complex embodied technology can probably be transferred reasonably easily from one environment to another without the transfer of high level skills, the transfer of non-embodied technology may require the parallel transfer of high level operating skills. Agreements to transfer such technology may, therefore, be costly to the transferor and unattractive in some cases unless a large potential market can be exploited. A diffusion barrier of this type might work to the detriment of smaller firms seeking to transfer technology from larger firms through licence agreements.(1)

A further barrier to the simple transfer of complex technology may involve defining precisely what is to be transferred. Much technology probably involves a complex relationship between machines and non-quantifiable 'skills' which may have been learned over a long period by the machine operators. Similarly, transfer of research results or experimental stage production processes, from a laboratory to a full scale industrial process may also be problematical to an extent. Low level skills in recipient firms may exacerbate such problems, as may cultural and linguistic barriers in other cases. It seems probably therefore that unless the technology involved has great advantages over existing techniques, the barriers to its diffusion may reduce the pace of the process. For smaller firms such barriers may prove difficult to surmount in the short term.

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1. Since smaller firms, even if successful, might be unlikely in many cases to generate sufficiently large scale royalties to justify the larger firms' transaction and opportunity costs (in management time etc.)

C. THE MANAGEMENT OF TECHNOLOGY IN SMALL FIRMS

Achieving successful management of the technology portfolio may be a more difficult process for smaller than for larger firms. While the decision making structures within such firms may be less than in some larger firms, the impetus to manage the technology portfolio may also be less than in larger firms where size per se may lead to a requirement for methods of strategic technology management to be developed. It is suggested therefore that technology management could arise in such firms as the result of crisis control processes rather than as part of a planned strategy in many cases.[1] Such crisis induced actions could come about through changes in the technological environments of small firms over which they might have less control than larger firms.

1. The Technological Environment of the Small Firm

The technological environment of the small firm may differ from the situation in larger firms. The capabilities of the latter[2] to devote larger resources to particular technological projects[1] may enhance their chances of success in chosen technologies.[3]

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1. See for example Hankinson A. op.cit. Investment Behaviour of Small Manufacturing Businesses.

2. Hawthorne E.P. 'The Management of Technology' McGraw Hill 1978

3. The larger firm may therefore possess the potential to enter areas not open to smaller firms. Clearly however, resources alone cannot guarantee the success of any new product project.

Small firms may, therefore, find it difficult to compete in innovation against larger firms with bigger resources. This factor clearly reduces the range of options that are open to many smaller firms and may restrict such firms to particular market areas .

The smaller firm may, therefore, have to concentrate its technological abilities in areas where it will not be disadvantaged by resource limitations. The use of industrial design, for example[1] to improve a product's appearance and incremental improvements to already existing technologies, may fall within the capabilities of many small firms such that they may not be disadvantaged in competition with larger firms. In developing such incremental improvements smaller firms may have advantages over larger firms' processes, since their managements may be closer to their markets and final customers than larger concerns.

Small firms probably possess skills that differ in both scope and scale from those present in larger firms. The nature of those skills and the nature of 'small firm' technology may also differ. It has already been suggested that many small firms exist through 'comparative' advantage in exploiting small market segments that may be unattractive to larger firms as well as 'absolute' advantage in other markets. In the latter instance, the technologies in which they operate may be unattractive to larger

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1. Design would appear to be an area in which small firms have an absolute as distinct from a comparative advantage over large firms.

firms as too 'craft' intensive or too service intensive. Such technologies may involve a high proportion of 'unembodied' technology i.e. they may be highly skill intensive.

2. The Process of Technology Management in Small Firms

Formulation of technology policy in particular small firms is likely to be subject to analysis of the strengths and weaknesses, opportunities and threats impinging upon those small firms *per se*, and their own particular capabilities. This process may not occur in a structured way in many small firms however. Technology policy and new product policy may not always coincide. While technology is probably defined by the core strengths of the firm in terms of its technological capabilities, new product policy suggests utilisation of those capabilities to produce a range of products pertinent to the available technological skills.

The external technological environment clearly plays an important role in the process of technology management within smaller firms. Management may need to define whether the company has the capability to become a 'technological leader' or whether a strategy of utilising already available technology and/or imitating technology developed by others might be more appropriate. The latter strategy might appear less risky for particular smaller firms, with finite resources conferring an ability to enter larger numbers of product areas with equivalent resources.[1]

Concentration on becoming expert in one particular field and devoting resources to this strategy may have negative implications for some smaller firms. First, in entering new fields resources may not be sufficient fully to develop alternative technologies. Definition of the resources required may be difficult prior to implementation. Second, outstanding success in a particular technology may encourage unwelcome attention from larger concerns in some cases. Such 'concern' might include market entry or predatory acquisition by such firms. [2] Protection of successful technological developments may also be difficult for the smaller firm to undertake successfully. While patents may provide protection in principle, the costs of protecting those patents may require large resources, often beyond the scope of smaller concerns.[3] If such resources are not available, patenting may be worse than useless in providing no effective protection, while drawing the attention of potential competitors to the technology involved and also providing a blueprint for imitation. A strategy of secrecy, the protection of 'know-how' and the use of registered design may be more successful.

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1. Development of a 'core skill' however, may be important in defining the potential of new products in the context of the company, whether those products are within current product lines or comprise diversification into other areas.

2. This might suggest that too great a success might be dangerous in creating external threats to the firm. In terms of independent survival a more 'low key' approach might be more appropriate in some instances. However it is also clear that some small firm managements do develop strategies to 'build up the business and sell out'.

3. See for example, Roos M.J. 'The Workmate Case' in Lowe J and Crawford N K. 'Innovation and Technology Transfer for the Growing Firm, op.cit.

Recognition of technological strengths and weaknesses may be difficult for many smaller firms. This may be particularly pertinent in the case of diversification strategies, where the choice between product or market diversification may be difficult to make. Technology audits may, in some instances, be helpful in defining directions for the firm to take. In larger firms such technology audits may take the form of highly structured processes.[1] In the smaller firm however, such processes are probably likely to be less formal but may still be useful as processes in defining areas of interest with potential for further development.

Technology audits may also be necessary in consideration of the sale of technology where a definition of the intellectual property to be transferred, is required. Clear and unequivocal specifications of exactly what the technology comprises are clearly necessary in licensing agreements, for example, both at the negotiation stage and at the point of transfer. Without such specifications potential purchasers of intellectual property may be unable to assess the technology accurately while potential sellers may be unable to price their technology accurately.[2] Technology assessment may be difficult however, particularly where much of the technology is not embodied in machinery etc. but comprises less tangible 'know-how'.[3]

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1. Jasper D P ' Technology Audit' in Lowe J and Crawford N K Technology Licensing and the Growing Firm, op.cit.

2. See for example (a) Contractor F J and Root F R. Negotiating Compensation in International Licensing Agreements. Sloan Management Review, 1981. and (b) Finnegan, M.D. and Mintz, H.H. Determination of a Reasonable Royalty in Negotiating a License Agreement'. Licensing Law and Business Report, June/July 1978

3. Teece, D.J. op.cit.

While explicit and implicit strategic decision taking may be necessary to define the direction that technology management should take in particular small firms, the management process within such firms is also likely to require action at several levels. Since the resources available to smaller firms are generally likely to be less in both proportionate and absolute terms than those available to larger firms, management of such resources is probably even more important to such firms.

Strategic technological development can probably be considered as a cascade of activities.[1] Small firms are unlikely to be able to carry out all technology management activities 'in-house' and may therefore be forced to sub-contract some functions 'out' or forego them altogether. The employment of specialist personnel such as patent agents, lawyers, licensing executives etc. may not be cost effective for such firms and 'in-house' expertise in these areas may therefore not be available. Small company managements may also not have the necessary time to devote to developing such skills. This suggests that technology management in smaller firms may occur as a result of external stimuli in many cases rather than as part of a longer term strategy.[2]

Development of effective technology management structures through policy formulation, identification of strengths and weaknesses, development and control, is probably a highly complex function.

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1. Encompassing Policy Formulation, Identification of core technological skills and the development of strategies to build upon such skills and management of new product/market development and diversification processes.

2. The implication of this process as it might relate to technology licensing is discussed in Chapters 5 and 6.

Most small firms may not have the capability to develop such structures effectively. However accurate identification of technological strengths and control over technology portfolios is likely to be an important factor in success. Recognition that the environment in which many small firms operate may be difficult for them to evaluate and the limitations that this imposes may be difficult for them to define however, potentially leading to technological management by default in some cases or through crisis control, rather than as part of a planned strategy in others.

Development of a strategy to manage the technological resources of the smaller firm, suggests a further consideration of how those technological resources should be translated into the development of new products for existing markets, or the development of new markets for existing products, or both. Clearly, firms have a choice between relying upon current technology in developing improvements to product ranges, or developing away from current product ranges by diversifying into new areas. It is therefore to the more practical aspects of product management and new product development in the context of the small firm that consideration is now made.

3. The New Product Development Process in Small Firms

The literature on potential strategies for new product development is extensive. Techniques for firms to identify new courses of action and develop new products by reviewing existing strengths and weaknesses, carrying out 'gap analysis'[1] and developing new product selection criteria, are examined in depth. The development process per se is also described in many publications.[2] It is not an objective here to develop these issues in any depth however, since they are clearly adequately covered elsewhere. The purpose of this review is, rather, to consider new product development (NPD) processes as they may be followed by smaller firms in the light of the characteristics of such firms and pressures impinging upon them in the areas of diversification and new technology implementation. Most new product development is usually considered to be a relatively risky process, even for those firms with professional, experienced, managements. The role and reduction of risk in the NPD processes are therefore explored in some depth below. Risk may arise at several points in the chain of activities leading to the introduction of a new product. These are therefore also examined below.

It has been suggested that many smaller firms may be better at 'invention' than 'innovation' and that the number of new product ideas emanating from such firms may be higher than in

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1. See for example Thomas, R.E. 'Business Policy' Philip Allan publishers, 1977

2. See for example Rothberg, R. 'Corporate Strategy and Product Innovation', The Free Press, 1976.

Rothberg suggests that:- "The Process of innovation is normally conceptualised as a series of six phases: Concept Generation, Screening, Business Analysis, Development, Testing and Commercialisation."

larger firms.[1][2] In the case of firms run by owner managers the number of decision makers involved in the new product decision process may be less than in larger firms. This might suggest that decisions on new products might take place more quickly than in larger firms in many cases. However, any decision to enter new product or market areas is clearly also likely to be constrained by resource considerations. Once again, smaller firm managements may be well placed to define the ability of their firms to undertake particular projects, in view of their more intimate knowledge of their firms' abilities. However, their ability in screening new product ideas for market potential may be less than in larger firms with greater functional specialisation and access to sources of market expertise.

Initial screening of ideas to define those with the greatest potential, taking into account the strengths and weaknesses of smaller firms is likely to be critically important. This procedure is likely to be particularly important in decisions to diversify into new products or new markets by the smaller firm. In those industries where research and development threshold expenditures are high, small firms may act in a conservative manner in considering new product ideas. A failure in developing a new product would be likely to be more serious than in a larger firm with greater resources. In industries with low research and development expenditure thresholds, smaller firms might be

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1. Bolton, R. 'Report off Committee of Enquiry on Small Firms' op.cit

2. Rothberg, T 'Corporate Strategy and Product Innovation' op.cit

anticipated to carry out a wider spread of new product developments however.

While idea screening can provide small firms with a shortlist of potential new products which they may be able to develop technically, technical success per se clearly cannot ensure the commercial success of a new product. The next stage of the NPD process is therefore business analysis, the estimation of future potential sales, marketing costs, profits etc. In this process small firms may well be at a disadvantage since their 'in-house' expertise may be less than for larger firms able to afford specialist marketing departments to carry out such calculations.(1)

Explicit or implicit idea screening can clearly assist in the identification of potentially good new product ideas. However, development of such ideas into product prototype form may be costly, and failure to predict such costs adequately could be problematical for smaller firms with restricted resources. Most prototype developments probably do not lead to commercially successful products.(2) Even where a product is potentially commercially successful however, lack of resources may prevent its successful exploitation in some cases.(3) High cost, high

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1. It was suggested in Chapter 3 that many very small firms were relatively undiversified but that as firm size increased so extent of diversification increased to a peak at approximately 150 employees. This would probably correspond to the point at which 'in-house' skills in analysing the potential of new products was also increasing.

2. Kotler, P. 'Marketing Management' Prentice Hall, 1976
The familiar 'decay' curve described by Kotler of idea to new products suggests a ratio of one successful product to fifty ideas.

3. The implications for outward licensing by smaller firms through such problems are considered in Chapter 6.

risk new product developments are, therefore, probably unattractive to a majority of smaller manufacturing companies.

Even in those instances where new products are successfully developed technically by smaller firms, the risks attendant upon their exploitation may be greater than for larger firms with resources adequate to market to a wide variety of potential buyers. This might suggest that methods of imitation or inward licensing could be attractive to smaller firms as an alternative. Evaluation of marketing costs based on the products' previous history could be facilitated in comparison with 'in-house' products with no previous marketing history. Identification of potential buyers of that product would also be facilitated.

D. RISK, GROWTH AND NEW PRODUCT DEVELOPMENT

Some characteristics of small firms, the role and management of technology in such firms and possible diversification structures have been defined and explored above. The earlier part of this chapter explored pressures leading to innovation and new product development. Innovation however, suggests change, and change in operating procedures and the introduction of new products and techniques may in the short term appear to be a riskier alternative than continuing current policies, unless external pressures force such changes. The risks of not innovating however, may lead in the longer term to stagnation and eventual crisis, particularly in industries where the rate of technical change is relatively high.[1] Small manufacturing firms are probably less robust than larger firms because of the dangers of technological advance making their restricted product lines obsolescent or uncompetitive. This might be anticipated to lead to pressures to diversify to reduce such risks. It is suggested therefore, that as a survival strategy the pressures on smaller firms to diversify may be greater than those impinging on larger firms in some instances.

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1. Conversely however, it is clear that many small firms have operated successfully in one product area with one product line over an extended period, without carrying out substantial 'innovation'. Such firms may however be subject to a degree of risk from technological developments and market entry by competing firms.

Reduction of risk is clearly likely to be a major implicit objective for small manufacturing firms. The purchase and sale of technology may reduce risk levels and enhance the flexibility of small firms in several ways. A policy of 'in-house' R & D for example could be more risky for smaller firms, than for larger firms.
since the number of new product projects would be likely to be less. The portfolio theory would suggest that in this case, smaller firms would be running greater risks. Reduced risk however, also suggests reduced potential return.(1) For smaller firms the advantages of reduced risks might be greater than the penalty of reduced return however.

1. Measurement of Risk

The risk/return equation noted above appears to be a well developed concept. Measurement of possible risk/return levels and its practical use may be more problematical however. Other authors have tried to model the risk process as it applies to the small firm by breaking down 'risk' into component parts and

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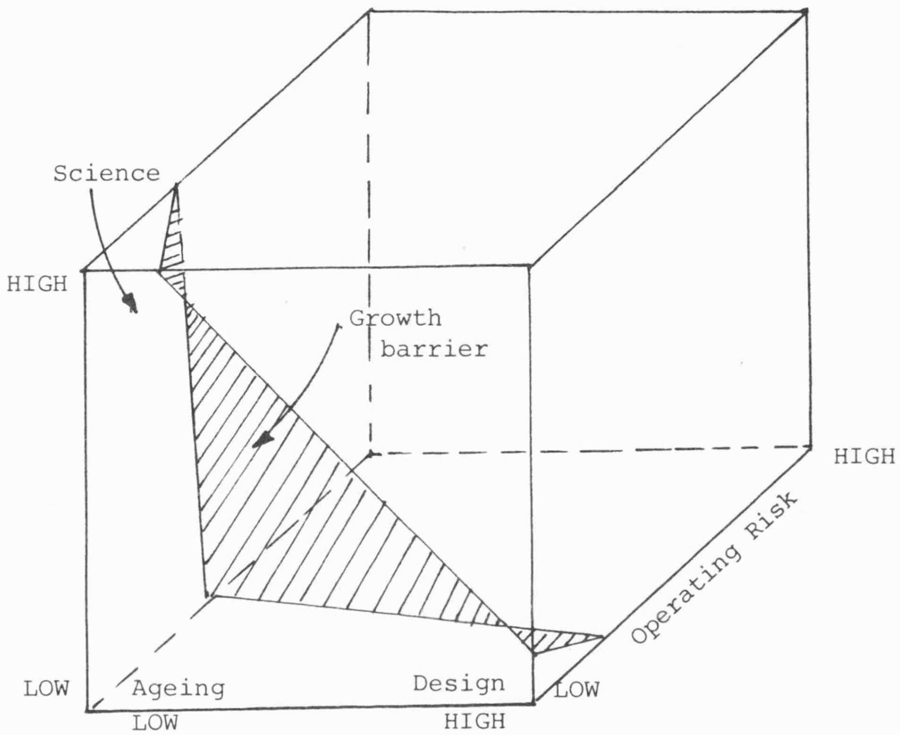
1. Weston and Brighams op.cit.

exploring each of these separately.[1][2]

Figure 4.1 Dominant Resource Pattern for Smaller Firms



From Hawthorne E.P. op.cit

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1. Hawthorne E.P. 'The Management of Technology' McGraw Hill, 1978 Hawthorne for example uses the technology or product market matrix as a base model (as explored in Chapter 3 above) but substitutes 'Risk' for 'Diversification'. He suggests that the further away from its own technological or market knowledge a firm moves, the greater its risk becomes in these areas. Hawthorne also introduces another risk classification which he defines as 'operating risk' to include all the non-technology/non-market factors affecting the operation of the firm,and concludes that smaller firms can only safely and realistically take on one major risk at any one time. Such firms are thus restricted by a growth barrier or threshold, through which it may be difficult for them to break. This can be demonstrated graphically as in Figure 4.1

2. Shah K and La Placa P.J. 'Industrial Marketing Management' 1981 Shah and La Placa further break the risk categories into marketing, competition, financial, business portfolio and regulatory risks in the context of overall business strategy.

If the concept of a 'growth barrier' as suggested by Hawthorne is accepted as valid it is probably useful to consider how smaller firms might break through such a barrier. For those firms exploiting small, specialised market sectors in which they may be dominant, diversification into other market segments may be difficult. Substantial resources may be required both to develop new technology and to exploit the new market through unfamiliar marketing means. The use of inward technology licensing to overcome both 'technological' and 'marketing' risks might be successful in some instances. While the costs of 'in-house' research and development costs could be reduced, purchase under contract would also be likely to provide access to marketing information from the licensor firm. Development of strategies to utilise inward licensing might, therefore, allow some smaller firms to compete with larger firms in those cases. In this context it may therefore be useful to explore the characteristics of smaller firms in relation to their growth potential.

2. Growth Characteristics of Small Firms

The 'risk factors' noted above may have an important role in defining the growth characteristics of the population of smaller firms. Where threshold expenditures are high[1] the proportion of small firms in a particular market might be expected to be low.

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1. Where expenditure on any phase of business development is high enough to exclude a proportion of the total population of firms, ie. Research and Development, Marketing etc.

This would suggest a possible classification for small manufacturing companies based on their market and growth characteristics. Such a classification might also suggest directions in which smaller firms might need to develop in order to grow. The matrix below proposes four categories of small firms within this classification in the context of their use of inward and outward technology licensing or other sources of bought in expertise.

Figure 4.2 Market/Growth Characteristics

		GROWTH	
		LOW	HIGH
M A M R A K R E K T E T	SMALL NICHE	Specialised non-diversifying	Specialised diversifying
	WIDE COMPETITION	Non specialised but product oriented	Non specialised market oriented

A	B
C	D

Companies in Category A might comprise those in small market niches where the market had low growth potential. Such firms probably of the 'parochial' type in many cases [1] may have problems in diversifying out of their market niches and crossing threshold barriers to diversify into other markets using current product lines or into other product lines utilising their own market expertise, because of a lack of 'in-house' R & D to develop such products. Such firms may have been expansionist at earlier stages of their development, but having failed to cross market barriers may have retreated into a policy of market satisficing. Their vulnerability to larger competitors breaking into their markets and to the new risks of obsolescence of current product lines however, may make them the subject of a high degree of inherent risk. Development of new products or into new markets by such firms may be likely to arise in a reactive manner, as the result of an external trigger signal, rather than through internal strategic choice in many cases.

Category B companies currently achieving and seeking high growth rates, may have reached, or be reaching growth barriers as proposed above. Continuation of growth may, therefore, require diversification away from current small market niches either into other small niches or into larger market segments. Many firms in this category could probably utilise technology licensing

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1. Carter S F and Williams, B.R. op.cit.

to obtain products to enter new markets or to exploit geographically distant or artificially protected markets in which they had previously been unable to compete. Inward licensing might in some cases also enable such firms to obtain technology to enter market segments dominated by larger competitors using the licensors technology based on marketing strengths to compete. Category B companies may comprise many very small or recently launched companies which have developed their initial produce line towards its maximum sales potential.

Category C companies with low growth rates and operating in oligopolistic markets, probably comprise a majority of small firms competing in non-specialist areas such as sub-contract work for other companies. Many of these firms could also be of the 'parochial' type.[1] Alternative strategies could include development into new product areas to build on 'in-house' fabrication skills to provide an 'own brand' product. An alternative strategy could include development into new product, process or skill areas, once again possibly through the use of licensing. However, a change from low growth sub-contracting skills to higher growth manufacture might be difficult for such firms to achieve successfully in many instances, without the injection of R & D expertise or marketing skills.

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1. Carter S F and Williams, B R. op.cit

Category D companies probably comprise a majority of the companies that were identified as 'diversifying' in a previous chapter. Seeking high growth through expanding market opportunities without having to develop high risk technologically based products, such companies might be expected to be the highest users of technology licensing in an endeavour to increase their market coverage at the lowest possible cost. With well developed marketing skills, many such companies could probably utilise inward licensing in a highly proactive manner if 'in-house' R & D skills allowed the 'tailoring' of licensed products to fit their markets. Strengths in the field of industrial design (for example) and other product related skills might be important in achieving such changes.

E. CONCLUSIONS

It was a major objective within this chapter to identify potential sources of technology for smaller firms and to define the technological environment within which such sources could be tapped. The process by which technological developments might diffuse into smaller firms was explored. Identification of 'core' technological skills and the development of strategies to build a portfolio of products upon those skills, was suggested to be a potentially problematical area for smaller firms with low degrees of functional specialisation. Smaller firms might therefore be subject to a greater degree of 'risk' than many larger firms.

In conclusion therefore, it is suggested that as a reaction to the real or perceived risks of growth, some smaller firms may react negatively, by retreating into their own small market niches and foregoing the potential benefits that such growth might bring. Development away from core skills may, therefore, only take place if an outside stimulus powerful enough to change company policy occurs. This might suggest that a classification can be made of smaller firms to identify those which are content to exploit small market niches and those which are able or wish to develop strategies to exploit new market areas. The implications of such a classification are discussed above.

This chapter was therefore intended to provide a linking role in drawing upon the empirical evidence on small firms and diversification presented in the two previous chapters, and introducing the concept of technology licensing as it could apply to the situation of smaller firms developing new technology policy. Development of strategies to 'manage' technology however, may occur as an implicit rather than an explicit process in many cases. The market areas in which many small firms operate may, therefore, arise as the result of outside influences or events impinging upon the firm, in addition to the development of new product strategies within the firm.

In the following chapter it is an intention to consider in some detail the role that technology licensing might play in the spectrum of methods for market exploitation by firms and the reasons for its use. It is intended that this analysis will draw upon the previous three chapters to provide the basis for a study in Chapter 6 of the strategic use of technology licensing by smaller firms.

APPENDIX TO CHAPTER 4

INVESTMENT PROJECTS

20% grants towards the cost of fixed assets, including plant, buildings and machinery. Maximum grant £20,000. These grants are only available for firms with up to 25 *employees*. The need for such investment must have been identified as a result of market research or other studies. (Projects are also not eligible for discretionary assistance under Section 7 of the Industrial Development Act 1982, but in appropriate areas Regional Development Grants may be claimed.)

FOR PROVIDERS OF SERVICES

If you PROVIDE SERVICES to small firms in the eligible areas, BIS can help with:

70% grants towards the cost of MARKET RESEARCH studies to help *groups* of small firms exploit the market potential – regional, national or export – for new and existing products, processes and services. Maximum grant £7,000 for overseas markets, £3,500 for domestic markets.

70% grants towards the cost of RISK APPRAISAL work done by or for providers of small scale equity investment to one or more small firms. Maximum grant normally £1,500.

55% grant towards the cost of providing COMMON SERVICES to a group of small firms. Grants can cover a maximum 3 year period.

55% grants towards the cost of new ADVISORY AND COUNSELLING SERVICES for small firms in eligible areas. Where the applicant is an existing organisation, grant will only be offered on an extension of services into new activities. Grants can cover a maximum 3 year period.

55% grants tow[illegible] the cost of providing informa[illegible]ion relating to product and technological innovation to small firms through DATABASES and other services. Databases need not be computerised. Grants can cover a maximum 3 year period.

50% grants towards the cost of employing ENTERPRISE PERSONNEL to promote the assistance available for small firms, including grants under BIS, and to encourage and help firms to take advantage of it. Grants can cover a maximum 4 year period.

Providers can be from the private sector, local enterprise agencies, chambers of commerce, large firms interested in helping small firms, or local authorities, depending on the service. If you are interested in providing new services for small firms in eligible areas then come along and talk to the Department's Regional Office.

There is no limit to the number of services for which you can apply. The Department may restrict the total amount of grant help which they give to any one firm or organisation.

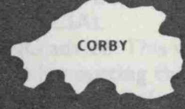
Depending upon the take-up of funds, applications will be accepted up to 31 December 1988. Grant will not be paid on work carried out after 31 March 1989.

TALK TO YOUR REGIONAL OFFICE NOW!

East Midlands Region

Department of Trade and Industry
Severns House
20 Middle Pavement
NOTTINGHAM NG1 7DW
Tel: (0602) 506181 Ext 358

Grants from Europe for small firms



Business Improvement Services

Grants from Europe for small firms

The European Regional Development Fund and the Department of Trade and Industry are offering £40 million of grants in areas affected by job losses in steel, shipbuilding and textile industries to help new businesses start up and existing small firms grow.

So if you are:

- setting up in business;
- an independent small firm employing up to 200 people, or part of a group employing that number;
- a consultant, or any other kind of organisation, providing or intending to provide a service to small firms;

then have a look at what the package of grants we call BUSINESS IMPROVEMENT SERVICES (BIS) can do to help you.

Remember these grants are to help small firms in Corby.

All manufacturing activities qualify for grant except the textile, steel and shipbuilding industries (unless they are diversifying into new activities). Most of the service sector is also eligible. But certain activities like retailing and personal services do not qualify.

BUSINESS IMPROVEMENT SERVICES can help a small firm with most stages of its growth and development from identifying new products, through market research and consultancy advice, to the purchase of fixed assets. Help can also be given with the provision of common services for groups of small firms. Some grants are paid direct to the small firm, some to the provider of the service.

FOR SMALL FIRMS

If you are a SMALL FIRM, BIS can help with:

- 55% grants towards the cost of a general BUSINESS CHECK-UP to establish key areas for improvement and possibly identify the need for specific follow-up consultancy work. Maximum grant £500.

MARKETING

55% grants towards the cost of a review of your current marketing activities and the drawing up of a MARKETING STRATEGY for the future. Maximum grant £1,500.

70% grants towards the cost of MARKET RESEARCH STUDIES to explore the market potential – regional, national or export – for new and existing products, processes and services. Maximum grant £7,000 for overseas markets, £3,500 for domestic markets.

55% grants towards the cost of TRANSLATIONS of market information and sales literature from or into foreign languages. Maximum grant £1,500.

MANAGEMENT AND FINANCIAL ADVICE

55% grants towards the cost of advice on improving your existing BUDGET AND CONTROL SYSTEMS, or the installation and operation of a new financial management system. Maximum grant £2,500.

55% grants towards the cost of BUSINESS PLAN AND FINANCIAL RESTRUCTURING advice. This would examine the scope for putting the finance of your business on a sounder footing and where appropriate, help you put together proposals for investment finance in the form of a Business Plan or report. Maximum grant £2,500. (Where the firm has already received a grant to help with consultancy on budget and control systems, maximum grant for this work will be limited to £500.)

NEW PRODUCTS AND PROCESSES

70% grants towards the cost of FEASIBILITY PROJECTS leading to the development of new products and processes. The work can be done in-house or by outside consultants. Maximum grant normally £35,000.

55% grants towards the cost of LICENSING-IN a new product, process or item of technology. You can employ a consultant to help you identify several propositions, evaluate them, and then negotiate a deal with a licensor. Maximum grant £5,500.

55% grants towards the cost of TRANSLATIONS can also cover technical documents; specifications; standards and legislative requirements.

COMPUTER APPLICATIONS SERVICE

55% grants towards the cost of investigating the merits of acquiring a microcomputer, and associated software packages, to meet the needs of your business. Maximum grant £1,500.

OTHER CONSULTANCY WORK

- BIS offers grants for a range of consultancy advice. If your business needs consultancy advice in an area not already described in this leaflet, this may be eligible for a 55% grant up to a maximum of £1,500.

COMMON SERVICES

- 55% grants towards the operating costs of a *group* of small firms in joining together to take advantage of common services, including typing, duplicating, book-keeping, word processors, or microcomputers. Grant will cover a maximum 3 year period.

PART II

CHAPTER 5

TECHNOLOGY LICENSING - SCOPE SCALE AND RATIONALE

A. INTRODUCTION

The objective of the previous chapters was to explore the relationships between the small firm and its environment and to endeavour to define important policy issues and pressures impinging upon it. Exploration was made of the impetus within such firms to innovate and diversify. The purpose of this chapter is to define the scope and scale of and the strategic and economic rationale for technology licensing and to explore its role in the strategic technological development process. Possible reasons for the use of licensing in all firms are considered and comparison made between the use of licensing in large and small companies. Study is also made of the alternatives to technology purchase and sale in all companies.

The term 'licensing' is an imprecise one covering a spectrum of activities from the purchase of rights to use a character (toys) through the purchase of product and process technology, to the transfer of complete factories to produce goods. The movement of people, which is undoubtedly a major source of 'technology transfer' cannot be classified under the heading of licensing, and is therefore not considered in detail here, although clearly such transfers can and do form an important part of licensing agreements in particular cases. Broadly, it is suggested that 'licensing' can be sub-divided into the transfer of a 'product' [1]

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1. Which could include character licensing and manufactured products

a 'technology'[1] or a 'process'[2]. In a previous chapter, the 'transfer of technology by contract' was suggested as being synonymous with licensing and this is the definition that is adopted here.[3] Any product, technology or process can probably be transferred if enough resources are devoted to it. However, the rationale behind such a transfer will include both a strategic and an economic factor. The latter factor might include problems of description, distance, culture etc. which might restrict such transfers unless an over-riding strategic impetus also existed.

In view of the increasing pace of technological change, it might be anticipated that the strategic use of technology licensing would assume an increasingly important role in the technological development of both large and small firms. In industries where product, technology and industry life cycles are becoming shorter the problems of survival for all firms are likely to become more

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1. Which might be a new product but could include an improvement to an existing product.

2. Which could be the technology necessary to make a product.

3. Other authors use other definitions, for example:

   (a) Contractor F J. op.cit. suggests that licensing is "The transfer of technology for compensation"

   (b) Kingman Brewster. 'Antitrust and American Business Abroad' McGraw Hill, New York, 1958
   (Licensing is) "the transfer of intangible property rights such as patents, trademarks, secret processes or technical information"

   However, both these and other definitions are fairly close to that adopted here.

acute. In these cases a strategy of minimal technological development may be particularly risky. Since technology licensing is primarily reactive rather than anticipatory, it might be assumed that it could provide a strategy for companies that were not technological leaders in some cases. This could be important in the case of smaller firms, unable to devote large resources to the development of new products and/or processes. Such reactive strategies however, could be dangerous in some instances in leaving the firm open to major technological developments by other firms. Such developments might make the company's products obsolescent and might not give enough time for competitive products to be developed. This could be particularly relevant in the case of the smaller firm competing with a larger concern where investment might be seen more as crisis management[1] rather than as part of a longer term strategic process.

Licensing is a major factor in world trade[2] which appears to have received little study or empirical investigation. This is, perhaps, surprising when the potential significance of transferring technology in this way is considered in a strategic, economic and sociological sense. A review of the literature on technology licensing pertaining to these topics comprises the first section and an integral part of the third and fifth sections of this chapter, although the available literature is probably

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1. Hankinson, A. op.cit.
2. Suggested to account for approximately 10% of total trading activity by revenue - see Contractor F J, op.cit.

neither extensive nor complete in its coverage of the subject. The specific subject of this thesis, technology licensing in smaller companies, appears to have been particularly poorly investigated.

The use of technology licensing in companies' product and market diversification strategies can be divided into the use of licensing 'in' and licensing 'out'. Such a dichotomy is probably necessary by virtue of the different rationales and techniques involved in company policy decisions to diversify into new products by licensing 'in' and into new markets by licensing 'out'. The impetuses behind and reasons for such decisions are likely to be different in each case.

While this chapter comprises a study of the use of technology licensing in its strategic and economic context, the separate but parallel policy issues arising in large and small firms, pertaining to licensing activity are also considered. Analysis is also made of the potential alternatives to the use of licensing in technology purchase and sale. A detailed analysis of the use made by small firms of inward and outward licensing is made in the following chapter through consideration of case study and other material.

B. LITERATURE REVIEW

The reasons for integrating a literature review of publications pertaining to the use of licensing are threefold. First, to introduce and explore the subject of technology licensing per se. Second, to explore some of the empirical work that has been undertaken in this area and third, to consider that empirical work in the context of a major subject of this thesis, namely technology licensing as it relates to the smaller firm.

In the context of any review 'technology licensing' should probably be differentiated from 'technology transfer'.(1) While a relatively extensive literature, mainly concerned with the problems and opportunities for transferring technology to third world countries exists, information on licensing per se appears relatively sparse. Information on the use made by smaller firms of technology licensing appears particularly poor, although some authors have concentrated upon the use of licensing in such firms.(2) Frequently, reference to the use of licensing in smaller firms is reported in the context of studies covering all firm sizes.(3)

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1. Within the literature, technology transfer is generally used to describe flows of technology from advanced to developing economies. The term therefore has political and social connotations that are distinct from the economic and strategic factors under consideration here.

2. See for example, Svensson, B. Success and Failure in Technology Import Through Licensing in Smaller Firms. Discussion Paper University of Linkoping (Sweden) 1982

3. See for example, Carstairs R T and Welch L, 'A Study of Outward Foreign Licensing of Technology by Australian Companies' Discussion paper prepared for the Australian Industrial Property Advisory Committee 1981.

A further weakness in the available literature appears to occur in the number of studies of inward rather than outward licensing. Clearly, for every outward license there exists a corresponding inward license. However, while the strategic rationale behind the use of outward licensing has been explored in a number of studies[1], exploration for the role of inward licensing in the development of new product and market strategies appears to be less well covered.

It is an objective of this brief review to introduce some of the recent, more important studies into the use of technology licensing. Further exploration of these studies is made in the rest of this chapter. An analysis of the literature does suggest that technology licensing may not have been explored in as much depth as some other areas of economic activity and to an extent the literature appears to be more noteworthy for its omissions than its analytical content.

Many marketing and business policy textbooks mention the use of licensing in passing, as one of a number of options open to companies intent on extending their product lines or markets.[2] However, the role and extent of licensing in an economic sense does not appear to have been explored in depth, although its

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1. See for example Wilson, R W. 'The Sale of Technology Through Licensing'. Unpublished PhD Thesis University of Yale, 1975

2. For example see Kotler, P. op.cit.

value in trading terms is apparently great.[1] Probably the most analytical contributions on the subject have been made by Contractor, Telesio, Wilson and Baranson who have carried out specific studies into the use of licensing _per se_.[2] The study by Contractor of licensing practice in multinational firms in the United States is probably the most detailed and useful study of these. The other studies also look at the use of licensing in the context of the multinational or large scale enterprises. While Wilson's and Telesio's studies of USA companies consider the use of licensing as a whole, Baranson and Teece consider more specific factors - Baranson the strategic advantages to firms of following the licensing option and Teece the costs and benefits involved in drawing up agreements to develop licensing strategies.

Earlier works based on empirical studies include investigations

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1. Considering the importance of licensing as a source of economic activity (cash flows of $14 billion in 1980 according to Contractor), the number of studies is very small.

2. Contractor, F J. 'Compensation and Costs in International Technology Licensing'. Unpublished PhD Thesis, University of Pennsylvania, 1980

   Telesio, P. 'Licensing Policy in Multinational Enterprises' Unpublished PhD Thesis. University of Harvard, 1978

   Baranson, J and Harrington, A. _'Industrial Transfer of Technology by US Firms under Licensing Agreements'_. Developing World Industries and Technology Incorporated. 1977

   Wilson, R W. op.cit.

by Lovell and Elkin[1 and 2]. While Lovell's 1968 study of 165 licensing executives is devoted entirely to licensing by US companies, Elkin's study of 32 firms in 1970 covers, by contrast, only British licensing practice. This national factor is a feature of the literature which is perhaps surprising when the international character of the subject is considered. The literature is further reviewed below in the context of an exploration of reasons for licensing and the volume of licensing activity. Consideration is made of the strategic and economic rationale for both inward and outward licensing.

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1. Lovell, E B. 'Domestic Licensing Practices'. NY National Industrial Conference Board Inc. 1968

2. Elkin, J. United Kingdom Foreign Licensing. Unpublished Thesis, Brunel University (UK) 1970

C. ALTERNATIVE STRATEGIES IN TECHNOLOGY SALE

In the context of a study on technology licensing, it is probably important to consider what alternative strategies might exist for firms wishing to sell technology <u>per se</u> as an alternative to selling goods embodying that technology, and the reasons behind the development of such strategies. Sales might take place for strategic, technological or market based reasons. In the first instance, company objectives might be inconsistent with development of a particular technology as the result of a change of strategic objectives, development into new technological areas, or as the result of a takeover or other change in company status. Technology based reasons might include product or process development costs increasing beyond company resources, a failure to breach threshold Research and Development barriers[(1)] or as the result of the development of 'spin-off' technologies [(2)] as a by-product of research into mainstream company technologies. Market based reasons might include a decision to exit a market because of increasing competition,or through development of new strategies in which a particular market becomes less important to the firm. Decisions to sell <u>technology</u>, however they arise,suggest the development of strategies to implement those decisions which might differ from strategies for product sale in some cases.

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1. See Chapter Four.

2. Defined as a technology which the firm is unable or unwilling to exploit itself.

Within a strategy of technology sale several potential alternatives are likely to exist, of which licensing may be an important method. Other alternatives could include the sale of patents, the sale of companies or divisions of companies, and the sale of expertise in the form of contract Research and Development expertise or secondment of key personnel under contract or through consultancy agreements.

1. Patent Sale

As a strategy for exploiting an existing portfolio of technologies, the sale of patents, as distinct from the sale of rights to use those patents, (i.e. a licence agreement) may be the most appropriate method in some cases. This may be particularly relevant in the case of rationalisation or reorganisation (1) where a company wishes to exit a technological area altogether, while endeavouring to obtain some return on its previous investment in that technology but without having a division or unit incorporating that technology that can be sold as a going concern. The advantages of selling patents are likely to be resourse related - a purchaser will pay for the patents while the costs of renewing the patents in question will then fall upon the purchaser, removing an ongoing charge from the seller. As an alternative to allowing a patent to

1. Freeman, B (Patents and Licensing Manager, Imperial Tobacco). Personal Communication to the author. Imperial Tobacco ceased paper and board making and sold all its patents in that field to a small company for exploitation.

lapse, consideration of patent sale might appear to be an important strategic choice in some instances.

2. Divestment of Companies or Divisions

The sale of companies or divisions of companies suggests a 'portfolio' approach to developing technology strategies for the firm, mirroring to some extent the use of outward licensing for particular products or processes. In many cases such sales may take place as part of a rationalisation process encompassing divestment of non-mainstream activities by sale or management buyout.(1) Sale might be considered where new management, taking control as the result of a takeover, wished to develop different strategic goals than the previous management. In other cases sale might be forced upon a firm through external pressure such as poor profitability. In such instances technology sale might be made solely to release resources for other activities. Development of promising technology leading to a requirement for Research and Development resources beyond the scope of the parent company might also suggest sale of a company as a 'technological unit'.

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1. See for example 'Divestment and Structural Change in UK Industry' by Chiplin B and Wright M in National Westminster Bank Quarterly Review. 1980

3. Contractual Sale

Sale of technology in the form of contractual obligation to other parties to develop new products or processes, or to overcome technological problems may also be an important method of exploiting technological strengths. For larger firms with costly Research and Development facilities, the use of those facilities under contract to others may be advantageous in some instances although there may also be dangers in providing such expertise to potential competitors. Some small and medium sized firms have developed strategies based upon a movement from the production and marketing of goods to provision of a mix of goods and technological services.(1) Lastly, other companies may offer their technological expertise solely as a service to other users. Contract Research Companies and Design Consultancies provide examples of this method of technology exploitation.

Possibly a realistic strategy for technological exploitation might lie in a consideration of several of the alternatives suggested above. Larger firms can possibly view both their technologies and their subsidiary companies or divisions as part of their technology portfolio and exploit their strengths by the sale or purchase of complete technological units. For the smaller firm, technology sale may be more restricted. In the context of this thesis, detailed exploration is now made of the strategic and economic rationale for outward licensing as an alternative to the other available options for technology sale.

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1. For example Lotus cars, which moved from manufacture to the development of a Contract Research and Development capability for other companies in the Motor Industry.

D. THE STRATEGIC AND ECONOMIC RATIONALE FOR OUTWARD LICENSING

Market exploitation can probably be considered as a spectrum of activities ranging through direct and indirect export, licensing, joint ventures and direct investment.(1) Choice of a particular method of market exploitation is likely to be affected by size, resource and policy factors particularly to each firm, and factors specific to the innovation or technology in question. Within the spectrum of activities, the extent of licensing may be conditioned by the strategic objectives of the firm, the potential of the alternatives and the characteristics of the relevant technology. The total volume of licensing may however, also be affected by sociological and other factors.(2)

For the purposes of this thesis the strategic and economic rationale for outward licensing is explored under the following headings: Profit and Associated Factors; Political Factors; Geographical Factors; Anti-Competitive Factors; Tax Related Factors; Sociological and Policy Factors; Resource Factors; Transfer Cost Factors; Product Specific Factors and other Strategic Factors.

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1. Kotler, P. op.cit.

2. Non commercial factors probably also impinge on the volume of licensing. International bodies such as the UN and OECD have three motives in encouraging the use of licensing and other co-operative activities. A political rationale - to reduce international tension by increasing co-operation; an economic rationale - to use global resources better; and a geopolitical rationale - to redistribute wealth by transferring technology from developed to developing countries. These issues have been touched upon above but are not directly relevant in the context of this thesis and will therefore not be explored further here.

1. Profit and Associated Factors

Profit, a major driving force behind economic activity is clearly also a major impetus to licensing agreements.[1] However, allied to the profit motive *per se* may be other factors which are explored below. The licensor company by sub-contracting its production and marketing to a local company is, by agreement, sharing the profit potential of that market. However, the potential of the market may (or may not) be more effectively realised by the local licensee than the licensor could by direct export or by other methods.[2] The realisable total profit may be higher in some cases under a licensing agreement than through direct export. The total potential size of the market may also be important in the profit maximising licence decision.[3] For small markets the potential maximum profit may not be worth the costs of setting up an export organisation or direct investment by the licensor. Local licensees may, however, be able to exploit small market segments successfully and profitably. In larger markets by contrast, higher levels of competition might also make the

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1. Telesio, P. op.cit. Telesio postulates that profit maximisation is always the underlying rationale behind all licensing activity. However, this statement is of little practical help in understanding the licence decision.

2. Kotler, P. op.cit. Licensing is suggested to be only one of a continuum of methods by which a market can be exploited. Other methods include Indirect Export, Direct Export, Licensing, Contract Research, Management Contracting, Joint Ventures and Direct Investment.

3. Elkin, J. op.cit.

potential profit for an exporting firm low. In such cases, the potential profit from direct investment or export might also be low in comparison with the potential income to be derived from a licensee already established in that market and with secure channels of distribution.[1] In such cases, firms may be prepared to accept only a proportion of the potential profit from that market. Even in less competitive situations, the licensor company may receive only a relatively small proportion of the total profit. Wilson for example suggests that licensors typically obtain no more than 25% of the expected profit from any particular market.[2] This 'profit' figure does not include the costs of setting up any licensing agreement. However, the opportunity cost[3] of setting up an export or direct investment operation in the market may also be high, particularly for smaller firms with limited resources and possibly more profitable investment opportunities elsewhere. In such instances licensing may be an attractive alternative strategy for market exploitation in some cases. The realisable profit for the licensor may be higher than through other methods of market exploitation. Even larger firms with extensive resources may find it difficult to exploit every potential market. In some cases licensing may therefore be a method of obtaining a profit at a low cost to the licensor in those markets

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1. Telesio, P. op.cit. Telesio shows for example that Pilkington Glass was forced into the licence route in some markets by pressure of local competition.

2. Wilson, op.cit. Wilson estimated from case studies and other material that licensor income from products fell within a range of 20-33% of the profit from that market.

3. Which may be low in comparison with direct export, commission or organisational costs.

which he would otherwise not enter. In such cases, licensing may be a profit maximising strategy in the context of the global operation of the firm. However, several authors have noted that rational profit maximisation may not be possible in the context of the uncertainties associated with individual projects[1] and this would indicate that other factors may possibly be at least as important as profit maximisation in an understanding of the licensing decision within the firm.

2. Political Factors

Political factors probably play a large part in many licensing decisions. Third world, developing and many socialist countries may import technology rather than goods in order to protect and promote indigenous industry and to preserve foreign currency.[2] The tariff barriers raised as a result of such policies may make direct export uncompetitive or unprofitable for firms endeavouring to exploit such markets. Economic exploitation of markets in these instances can therefore probably come about only through manufacture of goods within the tariff barrier, under licence agreements, joint ventures or direct investment. Conversely, some advanced countries also raise formal and informal tariff barriers to protect and promote specific industries; such policies may lead to an increase in collaborative ventures to overcome these barriers in some cases.[3]

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1. Freeman, C. 'The Economics of Indsutrial Innovation' op.cit.

2. Elkin, J. op.cit.

3. As recent investment and collaborative decisions by some Japanese firms in Europe show.

In overcoming politically motivated barriers to direct export, direct investment may be considered if sufficient funding is available. In such instances licensing may be an alternative that is considered only as a last resort.[1] This may be particularly true for multinational firms able to afford the high initial cost of direct investment.[2] However, where funds are restricted, the licensing option may be more attractive as a method of obtaining a return from an otherwise closed market. This might suggest that larger firms would be less likely to choose the licensing route to market realisation than smaller firms unless other factors such as cross-licensing agreements were also involved.

3. Geographical Factors

Geographically related reasons are, probably, a major factor in the decision of some firms to license out rather than to exploit markets by export. Transport costs can comprise a major price disadvantage for manufacturers of products that are bulky or high weight/low value.[3][4] Even for lower weight/ higher value products, the cost of transporting the product to distant markets may make it uncompetitive and hence the exploitation of those markets uneconomic. In firms (probably

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1. Carstairs, R T and Welch, L. op.cit.
2. Telesio, P. op.cit.
3. For example in the chemical industry, high transport costs for fertilisers and some low cost/high weight products may be responsible for the high incidence of cross licensing seen in the industry.
4. Pilkington Bros. Ltd. case study 1977 by J Quinn. The Amos Tuck School of Business Administration, New Hampshire

mainly the smaller ones) unwilling or unable to consider other forms of market exploitation such as joint ventures or direct investment, licensing might prove an attractive alternative for reasons that have been noted above.

Defining the volume of licensing due solely to the negative influence of transport costs may be difficult however, particularly where other factors are also involved. None of the empirical work recently carried out appears to have attempted to disaggregate this particular factor. It might be expected that the volume of licensing for any particular product might be a function of its weight/bulk:value ratio and the propensity of the firm to exploit the market through other methods than direct exporting. It is probably a major omission that none of the authors quoted above has considered the effects of product size per se and geographical restraints on the total volume of licensing.[1][2] This can perhaps be explained however, by considering the companies comprising the samples used in the studies by Wilson, Teece et al, who considered licensing in the context of multinational companies. Such companies probably have the resources available to be able to decide between direct investment and the use of licensing

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1. Elkin, J. op.cit. page 121. Elkin mentions geographical location as being important in some cases, but does not attempt to quantify such pressures.

2. Wilson, R.W. op.cit. page 79. Wilson studies the effect of geographical market segmentation based on product and market factors in the context of oligopolistic rivalry between firms. He points out that while geographical restrictions may not be explicitly written into many licensing agreements it may be implicitly understood by both parties that geographical segmentation exists due to the nature of the product and this may have an important anti-competitive effect, as explored below.

in any particular case, and this is indeed the choice suggested by several researchers in the field. Smaller firms, the subject of this thesis, may have a different choice between direct or indirect export of their products, and licensing, since their resources would not usually be large enough to consider direct investment. This is probably important in understanding the rationale of small companies in their use of outward technology licensing and is further considered in the empirical work and case studies below.

From a strategic point of view a distant licensee would probably be more attractive than one close to the licensors' home markets since the danger of introducing a competitor to those markets would exist. Licensor control over licensee use of technology may be difficult to exercise and hence the risk to the licensor of surrendering his technological lead to his licensee may exist. Such lack of control over intellectual property may partly explain the relatively low incidence of UK/European licensing amongst smaller firms.(1)

4. Anti-competitive Factors

The use of licensing and cross licensing agreements as an anti-competitive weapon in the creation of cartels to prevent the entry of outside companies into an industry is probably widespread.(2)(3) Governments and groups of

1. See Chapter 6
2. Wilson, R.W. op.cit. Wilsons main thesis is that licensing is used by large firms in this way.
3. The pharmaceutical industry has been suggested to be one example of cross-licensing activity leading to lower competition in particular markets

governments[1] clearly suspect that licensing can be and is being used by multinational companies in this manner, as recent legislation indicates.[2] While anti-competitive laws are probably aimed mainly at multinational enterprises, to prevent collusion in market sharing and price fixing agreements which are perceived to be against the public interest, the creation of such legislation may also have important restrictive effects on the scope and volume of licensing in smaller companies. Clauses forbidding market sharing may lead to a reluctance by smaller firms to consider selling technology at all, since even in their home markets their resources may not be sufficient to compete against larger foreign competitors willing and able to subsidise prices to obtain market share in the longer term. Such issues may be particularly pertinent in the transfer of technology by smaller firms to third world countries where fears of setting up competitors able eventually to undercut the licensor in his own market may be particularly prevalent. It is postulated therefore, that one result of such legislation might be a diminution in the total volume of international technology licensing.

Wilson provides a thoughtful discussion of many of the major issues involved in potentially anti-competitive behaviour through licensing. In particular, he made a comparative evaluation of

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1. EEC/OECD

2. Although the recent (1984) European Commission Licensing guidelines have waived restrictions for smaller firms.

the determinants both of R & D spending and licensing. His results suggested that whilst licensing was generally related to oligopolistic rivalry, the rate of technical change and the complexity of the product (as this relates to the number of product configurations possible with a given input), also had a substantial impact. In the case of complexity this was negatively related to licensing but positively related to R & D effort. He suggested that this was because R & D effort for products with complex configurations was often aimed at imitation of a varied set of differentiated products and the ability of the firm to do this reduced the demand for licensed industrial property.

In addition, Wilson was able to show that an industrial property system which was inadequately policed, and could not secure industrial property holders from imitation, was also likely to affect the level of licensing in various ways. It is suggested that an inability to police and enforce property rights in particular markets may have very significant consequences for small firm licensing in particular. Wilson suggests that cross-licensing may enhance the ability of firms to control market variables such as price, product quality and the number of competitors and entrants to an industry. Control of entry by competitors into a market may indeed be a crucial factor in the total quantity of licensing, by raising the costs of market entry to competitors. Such costs could make market entry for non-cartel firms more difficult since licensee firms within the cartel could always commence production effectively at a later point on the 'experience curve'(1) and would therefore be able to charge lower prices to deter entry by competitors. Clearly it could be in the interests of larger firms to utilise such agreements strategically, and this may in fact be an important method of diversifying into new products within their own markets, through cross-licensing agreements with competitor companies. There is some evidence that such agreements may be widespread.(2)

Telesio(3) by contrast suggests that cross-licensing can be in the public interest by reducing parallel development costs associated with particular technologies. His study draws a distinction between the patent pools of the past,dedicated to market sharing, and present day cross-licensing arrangements dedicated to technological advancement.(4) He also draws a distinction, based on empirical work between those firms utilising outward licensing solely as an alternative to direct investment and those other firms which, in addition, license

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1. Boston Consulting Group 'The Experience Curve Reviewed' BCG Publications, 1974

2. Case study evidence does exist. For example 'Intel and Motorola in Bubble Memory deal' - Financial Times 19.6.82 This cross-licensing agreement is quoted as "an effort on behalf of the Americans to fend off growing Japanese competition"

3. Telesio, P. op.cit.

4. It must be recognised however, that the mode of study used by researchers in studying licensing agreements, usually questionnaire and interviews, are unlikely to reveal anti-competitive behaviour. Statistical analysis of published data might be expected to be more enlightening. The study by Telesio developed in this direction, results,however, in no conclusion on anti-competitive behaviour.

to obtain access to licensee technology through 'grant back' agreements. Many of these firms are concentrated in the chemical, pharmaceutical and electrical machinery industries.[1] This may be an important finding in considering anti-competitive behaviour since accusations of cartel management and anti-competitive behaviour have been made against these industries in the past.

In conclusion, anti-competitive behaviour by larger firms in the use of cross-licensing is probably widespread. However, proof of this contention is difficult to show, although important apocryphal and case study material does exist. The response of governments to perceived anti-competitive behaviour of this sort is to pass legislation outlawing market sharing, price fixing and component sourcing agreements. This legislation may have a 'knock-on' effect for smaller firms, reducing the protection they might seek in outward licensing. The effect on smaller firms may therefore be a reduction in the amount of outward licensing they carry out. This subject as it relates to smaller firms is considered later in the empirical work.

5. Tax Related Factors

A detailed consideration of the role of taxation in the rationale for outward licensing is beyond the scope of this thesis. There are important and complex issues involved, and

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1. Telesio, P. op.cit.

case law is constantly changing the legal status of payments under licensing agreements.[1] Under most national legal conventions, taxation of earnings under licence agreements can be considered as contiguous with taxation on the earnings of other forms of market exploitation.[2] However, in two areas, other factors may apply.

There is some evidence to suggest that royalty payments from developing countries and to smaller companies may be effectively taxed at a lower rate than payments in other cases. Contractor for example, hypothesises that remunerations under licensing agreements from developing and Eastern European countries are more likely to be paid as fees for technical assistance than as royalties on output, due to problems in those cases of auditing output by licensees.[3] It is postulated that smaller firms may also, in some cases, receive a substantial proportion of their total licence income as consultancy and assistance fees rather than in the form of royalty payments on licensee production. Such payments might have an important role to play in the viability of some licence agreements and would tend to be the cause of an understatement of the value of the agreement to the licensor[4]. Such hidden licence income would be

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1. For example see papers in 'Domestic and International Licensing of Technology' December 1980/January 1981. New York and San Francisco
2. Contractor, F.J. op.cit.
3. Contractor, F.J. op.cit.
4. See Appendix 5.3 for example, Lowe J and Crawford N K 'Outward Licensing as a Marketing Strategy - An Analysis of Returns'. Discussion Paper - Bath University, May 1983

extremely hard to quantify accurately. The extent of such payments in the context of small firms per se is considered further in the empirical work.

6. Sociological and Policy Factors

It is probably difficult to identify the effect of sociological factors in the policy making of multinational firms. Survival, profit maximisation and pragmatism have all been suggested as major forces impinging upon decision makers in such firms. Policy decisions in such firms are possibly based more on available resources than on any idiosyncracies of management. In smaller firms however, particularly those which are owner managed, 'personality' factors may take on more importance. The rationale for outward licensing in small firms may therefore be at variance with the rationale in larger concerns in some cases.

It has already been suggested above that many smaller firms value independence above other factors. This might be important in the formulation of market exploitation strategies by small firms,since utilising licensing as a means of exploiting a foreign market could give the licensor company greater control over that market in some cases than could direct export, utilising agents. It is suggested that a licensee company might be more likely to try to exploit the market fully than an agent would. Exporting might require further expansion of production, sales and marketing facilities leading to an increase in the size of the enterprise, complexity of management structures and hence to a diminution in direct management control of parts of the enterprise. The response of smaller firm owner managements to the choice between expansion through export with less control and foregoing the benefits of such expansion might, therefore, be the latter rather than the former in some cases. Market exploitation through licensing agreements might be an attractive alternative as a method of exploiting technology without the need for growth in manufacturing per se.

7. Resource Factors

The ability of firms to exploit markets in particular ways may also have an important effect on the total volume of licensing activity. While multinational firms may have the choice of market exploitation between export, direct investment or joint ventures (including licensing agreements), the choice facing smaller firms is probably limited to direct exporting or licensing agreements, because of a lack of financial, technical and managerial resources required by other methods. Even multinational firms resources are not infinite however,(1) and licensing might be attractive as an alternative to direct investment in home markets(2) where the opportunity costs of

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1. Larger firms clearly have the ability to raise funds in the marketplace for good projects. However, their resources of skilled manpower and trained management may be less extensive and this may be a limiting factor on the number of operations they could carry out at any one time.

2. Teece, D.J. op.cit. p.54. Teece further considers that large firms' transfer costs may be lower than for smaller firms' and this would tend to enhance the ability of such firms to carry out transfers.

direct investment might be high, or other barriers to direct export exist.[1]

Financial restrictions may be more acute for smaller firms, unable to raise money on capital markets, than for larger firms. Where exporting to particular markets is restricted in this way therefore, licensing may be an attractive alternative method for the smaller firm to exploit that market. Such pressures would probably tend to increase the amount of licensing activity in the small firm sector as a whole and might be expected to make the value of particular licences to small firms proportionately more important than to larger firms. Once again, however, the opportunity cost of small company management undertaking licensing work might be a restricting factor in some cases.[2]

Trained personnel are, possibly, the most valuable resource of many smaller firms. Optimal application of this resource by applying it in a particular way may be crucial for the company's success. The opportunity cost of employing technical personnel in any particular application probably represents, therefore, a critical calculation for many smaller firms, even where such an estimate is not formally made. Licensing agreements with long term requirements for technical personnel and relatively long term paybacks through royalty agreements leading to a worsening in cash flow characteristics may represent a major reallocation

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1. Carstairs, R T and Welch, L. op.cit.
2. This issue is further explored in the empirical work in Chapter 6.

of resources and an unacceptably high opportunity cost for the smaller firm. In contrast to the financial restrictions noted above this would probably tend to decrease the total volume of licensing in the small firm sector. Once again an exploration of this factor comprises part of the empirical investigations below.

8. Transfer Cost Factors

A measure of the cost of transferring technology from one entity to another is clearly likely to be important in understanding the rationale behind technology licensing.(1) Technologies with low transfer costs might be anticipated to be particularly important in the total volume of licensing activity. However, the status of the recipient firm may also be important in the case of transfer. In this, negotiation and search costs may be an important imponderable factor. Search and negotiation costs, possibly involving large inputs of management time, may affect the profitability of any licence agreement. The costs of transfer may also be related to the ease of defining the technology to be transferred. Thus where licensing involves mainly 'embodied' technology in the form of drawings, capital equipment or other easily definible technology, transfer may be more simple than where intangible skills of 'know-how' is involved. 'Disembodied' technology comprising 'know-how' and other less easily definable

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1. Teece, D. op.cit. for example in his study of Multinational Corporations and Transfer Costs states "It is plausible that a dominant consideration in the international transfer of technology is the cost of transfer"

intellectual property may be more difficult to transfer and is also probably more difficult to itemise prior to transfer, so that both licensor and licensee companies may have difficulty in specifying precisely what is to be transferred and hence in pricing the licence accurately.

9. Product Specific Factors

Certain products are probably affected by fashion or other market factors to a large extent. Where product life cycles are short, market penetration and profit maximisation by home based production and export may be difficult to achieve. In such cases, licensing particularly for smaller firms may be a realistic method for exploiting particular markets.[1] Instances of product specific factors impinging on the licensing decision probably also occur in industries where the rate of technological change and innovation is particularly fast. In such instances market exploitation may require production facilities near the market for success.

10. Other Strategic Factors

While all the factors noted above impinge upon the decision to license 'out', they may in some cases be overridden by strategic considerations which could also be related to the economic implications of new product development. For smaller firms, selling the licence rights to a product could be particularly important

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1. In the toy industry for example, licensing appears to be very widespread, probably because the life cycle of a particular product may be very short. Fulfilling market demand may be difficult for smaller firms, leading to the extensive use of licensing.

as a method of recouping development costs. In the case of some firms, such development costs could impose a heavy burden leading to a crisis sale of technology under licence.[1] However, it seems likely that in many instances, the use of outward technology licensing in the exploitation of a foreign market may arise as a "second line or residual international marketing mode because external pressures constrained or prevented the use of exporting."[2] This might suggest that the use of outward licensing may be a reactive rather than a proactive strategy in many instances.

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1. For example, the case of Dragon Computers in the UK which was forced to sell its profitable microcomputer to cover losses incurred elsewhere, just as that product was producing a high return in early 1984.

2. Carstairs, R T and Welch L. op.cit. In their study of outward licensing by small/medium and large Australian Corporations, these authors found that licensing was often used as a 'last resort' strategy.

E. ALTERNATIVE STRATEGIES FOR TECHNOLOGY PURCHASE

Factors affecting the strategic impetus towards technology sale through licensing, the sale of patents of operating units and through contractual Research and Development agreements have been considered above. In view of a major thesis objective of considering inward licensing in the smaller firm, consideration must also be made of the alternatives to such licensing. Technology purchase might take place because of an inability to generate suitable new technology within the firm through cost or other resource limitations or through a recognition that technology purchase might be more cost effective than 'in-house' development in particular cases, even though adequate resources were available in the firm.

Within a strategy of technology purchase, several alternatives exist, mirroring to an extent the avenues for technology sale explored above. However, potential alternatives for technology purchase are probably greater than for technology sale, including inward licensing, the use of contract Research and Development or Design expertise, acquisition of companies and the recruitment of suitably qualified personnel.(1)

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1. While the recruitment of personnel is not 'technology transfer' per se, under the definition for 'technology' adopted in Chapter 4, such recruitment would confer upon the recruiting firm, the ability to utilise new technological expertise.

1. Product Purchase

Purchase of technology through the use of contract Research and Development or by utilisation of contract design companies could be an alternative strategy to the use of technology licensing or company acquisition in some cases. As a complement to existing 'in-house' skills, purchase of technological skills in this way could overcome gaps within the firms' technology portfolio. Organisations offering contract services in the United Kingdom include the Research Associations, where collaborative and pre-competitive research may also be carried out, in addition to other commercial organisations. For the smaller firm, purchase of contract Research and Development expertise may be a realistic method of product or process development. However while licensed products can be evaluated on the basis of their record to date the potential of contract research may be less easy to evaluate prior to project completion. A strategy of contract research to further develop inward licensed products might be one method for product portfolio development.

2. Company Acquisition

Purchase of technology through the acquisition of other (smaller?) companies with particular technological skills is one alternative to technology licensing or other forms of technology purchase. Such purchase may be advantageous to companies in providing not only technological but also other skills associated with that technology such as marketing or other customer related disciplines. Purchase of a company allows immediate entry to the new market. However, unless the company being purchased complements the already existing company management structure and operating style, there may be problems in assimilating the acquisition. Such problems could include a difference in company culture[1] and the obtaining of other, miscellaneous activities associated with the purchased company, which might not be relevant to the purchasing company's strategic objectives. This situation might be contrasted with purchase of a technology under licence where a much more specific and definable intellectual property could be purchased. For larger companies able to operate with a devolved management style, such concerns might be less relevant than in the case of smaller firms with a more participative management structure.

3. Key Personnel Acquisition

The recruitment of suitably qualified personnel may be one method of developing new technological skills and as an alternative or complement to inward licensing may be a viable strategy. Where non-patented or patentable technology is involved, recruitment of such personnel may assist in diversification into new areas of expertise. Even where entry to a market dominated

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1. Thomas, R.E. Business Policy - op.cit.

by patented products is involved, designing around such patent protection is likely to be assisted by personnel skilled in those areas of expertise.

For larger firms, diversification into new technological areas by acquisition of smaller companies skilled in those areas is clearly a major alternative to the use of technology licensing or other forms of technology purchase. Many larger companies have developed in this way.[1] For the smaller firm, development through acquisition may be less feasible than technology purchase through other methods. In the context of the strategic opportunities available to both large and small firms and the opportunity costs of developing particular projects, consideration is now given to the strategic and economic rationale for inward licensing as an alternative to other available options for technology purchase, explored above.

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1. For example, Rio Tinto Zinc plc, where the author was employed between 1975 and 1979. In 1983 this company owned 534 subsidiary companies throughout the world.

F. THE STRATEGIC AND ECONOMIC RATIONALE FOR INWARD LICENSING

The strategic and economic rationales for companies licensing 'in' probably differs from the rationales for licensing 'out'. While licensing 'out' can be seen as a market diversification process in many cases, licensing 'in' is probably more commonly used as a method of product diversification. For smaller firms licensing 'in' could probably also be an important crisis prevention technique in some cases enabling a product or process to be introduced quickly.[1] Many companies act as either licensees or licensors suggesting different strategies within the two groups of firms. The literature describing the reasons for and process of licensing 'in' appears to be even less extensive than that for licensing 'out'.[2] This may be because licensing 'out' is a recognised method of market development while licensing in is evaluated as a crisis process or failure on the part of the licensee, to develop his own technology. Licensing 'in' is a function that is difficult to classify within the firm. Unlike outward licensing it does not fall within either the marketing or Research and Development function.

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1. Hankinson, A. op.cit.

2. Several studies treat licensing as if it were a process in which the licensor was always proactive, with licensees as passive partners. See for example, Telesio, P. op.cit and Wilson, R W . op.cit. The empirical work described in Chapter 6 below would indicate that in many cases it is in fact the licensee who is the proactive partner, particularly in the case of smaller firms.

The strategic and economic rationales for inward licensing probably also differ in several respects, within companies, from the process of licensing 'out'. There are however, considered to be several areas in which licensee and licensor rationales may coincide. These might occur for example in attempts to overcome tariff barriers, geographical barriers, or in the organisation of market sharing/cartel arrangements. Factors specific to inward licensing may be classified under the following headings - Development costs; Speed; Technology Push; Diversification Factors and Other Strategic Factors.

1. Development Cost Factors

Product development costs for many technologies, as suggested in previous chapters appear to be increasing over time. Such cost increases may prove to be a substantial barrier to smaller firms unable easily to raise development finance. The result of such processes may be to reduce the capability of smaller firms to enter new markets by the introduction of new products . Technological progress in the microcomputer markets (for example) demonstrates this process.(1)

Even larger companies may find it difficult to spend enough to stay above technological thresholds in all their technologies.(2)

1. See for example Financial Times, 21.5.82, 'Big Boys Muscle in on Minicomputer Market'

2. Steed, G op.cit.

In such instances, inward licensing may appear an attractive alternative to 'in-house' R & D in some cases, particularly where a specific innovation is required.[1] Such licensing activity suggests, however, that there is no market conflict between licensor and licensee, which in the case of multinational firms may frequently not be the case.

Many smaller firms, concentrating on 'national' markets, may be less likely to be competitors with potential licensees than larger firms. In addition, development costs may be so high in some cases that 'in-house' development of particular technologies may be impracticable for them. In such cases, inward licensing may be a suitable alternative method of obtaining that technology. It is suggested therefore, that the use of inward licensing can, in principle, extend the technological capability of smaller firms into areas they might otherwise not be able to enter.

The rationale of both large and small firms in inward licensing to overcome Research and Development costs may, therefore, be different. While larger firms may be able to take a longer term strategic view that licensing 'in' provides a cheaper way of entering a new market than 'in-house' development, smaller firms may be forced to this conclusion by other factors.

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1. Teece, D J. op.cit. p.19. "From the buyer's point of view it is clear that transfer is often the least expensive method of acquiring access to an innovation".

   Teece also states that .... (licensing) "is perhaps the lowest risk route to the acquisition of technical ability and excellence in manufacturing".

If their strategy is to break into new markets where there are high threshold development costs, the only way of overcoming these costs may be to collaborate with others who have the resources to develop the technology in question. In such cases the smaller licensee may be able to offer local marketing expertise to its larger licensor, in exchange for a transfer of technology.

A strategy of survival, which may be a major impetus for many small firms, could also lead to the use of licensing to overcome research and development costs. Such reactive licensing, to meet external threats or take advantage of opportunities, could provide such firms with a method of competing with larger rivals, at a smaller cost than 'in-house' development. The implications of this are explored in more detail in the following chapter.

2. Speed Factors

Companies may require technology quickly for several reasons. Realisation that a product is becoming obsolete; Introduction of a new product by a competitor; Changes in legislation for pollution control or safety standards or increasing customer resistance, may all be factors leading to a requirement for new product introduction.

While, as noted above, the Product Life Cycle concept is not universally accepted, products do become obsolescent in particular instances and are superseded by improved technology. In such cases, particularly where management has miscalculated the rate of technological change, a gap may arise between the launch time for new 'in-house' developed products and the realistic life span of current product lines.[1] Licensing can provide a product to fill both the time and the market gap in some cases. For smaller firms subject to high sensitivity to and less control over market forces, licensing may provide enhanced flexibility in the introduction of new products to replace ageing product lines in particular cases.

Similarly, competitive pressures lead to a realisation by management that lead times on 'in-house' developments may be unrealistically long if market developments are to be countered. Once again, licensing can provide the speed and flexibility to overcome the time problem in principle.

Lastly, introduction by government agencies of legislation may have important negative effects on firms' product lines. Such cases could occur in the pollution control, pharmaceutical and other industries,[2] but could apply equally to safety regulations

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1. Sunday Times 15.11.81, p.61. British Leyland's Triumph Acclaim, manufactured under licence from Honda was introduced only 18 months after agreement was reached to license. An 'in-house' designed car would have taken four years to bring to production.

2. See for example Financial Times 29.6.82. 'Men and Matters' This case describes the banning by UK health authorities of small amounts of chloroform in 'Victory V' lozenges, leading to a change in formulation followed by customer resistance and a drop in sales of 25%.

introduced to protect consumers in toys, paint, food and other industries. Where legislation is introduced, technology may have to be acquired quickly so that products can remain "within the law". Licensing could have a major role to play here in transferring technology to overcome such problems.

3. Technology Push

The concept of technolgoy push has been explored in some depth above. Introduction of a new technology may supersede existing techniques in a major or a minor way. However, replacement of existing plant might not always be necessary as the result of the introduction of a new process or technology by a competitor. In many instances, production utilising existing technology might still be cheaper than purchasing new technology, since the existing plant could already have been amortised, and could therefore be viewed as a sunk cost while production under the new technology would have to be priced to take account of the cost of new machinery. However, in other cases the new technology might be so superior that the older technology was rendered obsolete.(1) Such instances of revolutionary technology change may however be relatively infrequent. More frequently, the improved technology can give a long term advantage to its owner that competing firms must try to overcome. In such cases,

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1. As for example in the case of the introduction of the transistor as a replacement for valve radios.

licensing 'in' from that competitor where possible, may be more advantageous than attempting to design around the technology.(1) This would particularly apply where the potential licensee had no conflict in his markets with the licensor.

Lastly, customer resistance to a product may occur through changes in fashion or for other non-technical reasons over which the firm may have no control. Such changes in demand are probably particularly difficult to plan for. Specific industries may be particularly prone to changes in fashion. The toy industry, for example, is suggested to be particularly 'fashion conscious' as suggested above. In such industries exploitation of a product over a short life cycle may be enhanced by the utilisation of licensing agreements. The potential for licensing 'in' in such industries is therefore likely to be high.

4. Diversification

Diversification through inward licensing may be unusual in the case of multinational firms able to acquire technology through the purchase of complete companies rather than purchasing the technology alone. In such companies, a 'portfolio' of companies rather than technologies may be built up, as the structure of many 'conglomerate' firms suggests. The choice for diversification in such firms may therefore be between 'in-house' R & D and

1. As for example in the Pilkington float glass process. This case and the importance of licensing to the company is further explored on page 272.

company purchase. Smaller firms probably have a different choice, between 'in-house' development or technology purchase via licensing or other co-operative agreements. An exploration of the utilisation of licensing in the diversification strategies of smaller firms forms a major part of the empirical work below.

5. Other Strategic Factors

Licensing 'in' as a strategy can be explored in the context of the short term or long term development of the company. In the short term it may provide a company with the ability to overcome a particular technological problem or product portfolio 'gap' at lower cost than 'in-house' development, and in a shorter time scale. As part of 'crisis management' therefore, and within a strategy of survival, inward licensing may be important to large and small firms in some cases. As a longer term strategy, licensing 'in' may also be important to both larger and smaller firms. For larger firms such licensing could be important within a strategy for the utilisation of cross-licensing agreements with other companies to achieve a higher technological capability than would otherwise be the case. The smaller firm might benefit by inward licensing carried out to overcome threshold barriers that would otherwise prevent it from entering particular markets.

G. THE SCOPE OF TECHNOLOGY LICENSING

Probably any technology that can be defined either explicitly or implicitly can be licensed. However, factors such as the transferability of the technology per se and the status of the recipient of the technology are probably more important in defining the level of licensing activity in practice. Because of the nature of the available statistics(1), disaggregating the returns due to licensing from other sources of economic activity can be difficult.(2)

In particular countries and industries the use of licensing may be more widespread than in others, since the requirement for and transferability of different technologies may differ, as will such factors as the history of collaborative agreements and ease of access to advice about the technology transfer process. However, in light of the objectives of this thesis, it is probably important to define the levels of trade in technology per se and the potential returns accruing to such trade.

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1. Until 1970 the UK Department of Trade kept detailed statistics of licensing activity. These now appear aggregated into broader statistics. See for example, 'British Business' 12.6.81, Payments and Receipts on Overseas Royalties. HMSO

2. Definition of what comprises a 'licensing agreement' may also be difficult. While licensing of patents clearly accounts for a substantial proportion of licence income, the licensing of 'know-how' and income defined as consultancy or aid fees is less easily measured. For this reason much licensing activity may go unrecorded in the statistics.

1. United Kingdom and International Trade in Technology

Internationally, receipts due to licensing activity comprise only a small (though growing) proportion of the total trade in goods and services. Statistical evidence on the total amount of licensing is, however, difficult to obtain. Few national statistical offices record licence income and expenditure separately.(1) However, while licensing receipts may account for only a small proportion of total trade receipts, they may comprise a disproportionate proportion of profit within particular industries and at a company level.(2) Conversely the costs to a licensee industry or company may comprise a high percentage 'tax' upon profit levels. A consideration of the profitability of licensing activity as a whole may therefore be pertinent in considering the strategic and economic importance of licensing *per se*.

An in depth exploration of the UK national and international trade in technology is only relevant in this thesis, with its emphasis on the strategic use of licensing by smaller firms,as a background to the environment in which such companies must operate. An analysis of UK trade in technology was, however, made as part

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1. In the UK however, licensing receipts and expenditures *are* listed separately.

2. Pilkington Bros. plc. accounts 1980/81/82. Licensing income accounted for an average of 47% of the total profits over this period. See page 272.

of the Leverhulme project referred to above.[1]

Other authors have carried out major research in analysing the flow of technology royalties between countries over time[2], and these suggest that the UK performance in its technology balance has been relatively good in comparison with other major industrialised nations. However, this conclusion in view of an apparently declining performance in UK innovative activity[2], does require explanation. Davies and Rosser suggest that the explanation lies in past economic strength, the time lag effect, a shift in production from the UK to overseas, leading to a reverse flow of profits, or to a perception of the UK as a 'technology middleman', importing from advanced countries and exporting to developing countries.

Historically, licensing has probably been used by some countries as part of a strategic process of technology management. The Japanese, for example, used licensing in a highly proactive manner, to reconstruct and develop their industries after the second

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1. Lowe J and Crawford N K. Technology Licensing and British Industry. Paper presented to Small Business Conference in York, 1982.

2. Davies H and Rosser N. 'International Trade in Technology - A Survey' in Technology Licensing and the Growing Firm by Lowe J and Crawford N K. Pergamon Press, 1984.

world war.[1] Such licensing activity in monetary terms was probably not a particularly significant factor in total trade terms. Its economic significance however, in fostering the growth of modern industry in Japan is incalculable.
Study of the Japanese use of licensing has been made by several authors in some detail.[1] An analysis of its extent and importance are beyond the scope of this thesis however, with its theme of the smaller firm, and will not therefore be considered further here.

It is also clear from the statistics that a majority of licensing is carried out between companies in the developed countries rather than between developed and developing countries.[2] Of the remainder, possibly a majority occurs between large multinational firms and firms or governments in less developed countries. This is probably important in the context of the study here, into the licensing activities of smaller firms.

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1. See for example Tsurumi Y, 'Technology Transfer and Foreign Trade - The Case of Japan' unpublished PhD thesis, Harvard Business School, 1968.

   Japan used selective technology licensing agreements to promote particular industries. This led to a severe negative balance of payments on the technology account. In 1980 however, on new licence agreements. Japan swung into balance (of 38.6 million pounds). See Financial Times 12.6.81 reporting statistics by the Japanese Economic Journal.

2. Contractor F. op.cit. Contractor suggests that three-quarters of all licensing activity is carried out between 14 developed countries of the OECD.

2. Licensing Returns

Licensing activity can be viewed in terms of an agreement between licensor and licensee to exploit a particular market using the licensor's technology and the licensee's production and marketing skills. The licensor is thus exploiting the fruits of his research and development expenditure through the licensee. Analysis of the returns to licensing can therefore be made in two ways: as a measure of the return made by the licensor on his R & D expenditure, or as a measure of the proportion of profit from that market obtained by each of the two parties.(1) In this process the pricing of the licence is clearly a critical factor, which can prove to be problematical in many cases.(2)

Analysis of returns to licensing as a proportion of the cost to the licensor of carrying out R & D may be difficult to ascertain, particularly where company R & D expenditures are not disaggregated to particular projects. A further complication can arise when exploitation is made by the licensor of the technology in its home market through the production of goods.(3) However, the marginal profit obtained by the licensor can be very high if the

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1. With the assumption made that the licensee exploits the market equally as effectively as could the licensor through direct export.

2. Finnegan, M B and Mintz, H H. 'Determination of a Reasonable Royalty in Negotiating a Licensing AGreement'. Licensing Law and Business Report (New York) 1978

3. Since in this case development costs may be viewed as expenditure that would have been made whether or not licensing of the technology was made. Returns to licensing could therefore be offset against negotiation and administration costs only, clearly giving a much higher apparent return than if R & D costs were also taken into account.

transaction and support costs involved in the licence agreement are not too high.(1) It seems apparent therefore that profitability can only realistically be calculated on the basis of particular cases and in the context of each agreement being subject to licensor policy factors being taken into account.

Analysis of the proportion of returns divided between licensor and licensee provides, perhaps, a more fruitful method of ascertaining the profitability of licensing in general in comparison with direct exploitation of a market by means of export. Even here, however, non-monetary returns such as cross-licence agreements or provision of reciprocal facilities etc. may provide a 'hidden' income or advantage to the licensor. In the case of smaller firms as suggested above, such income may be concealed as consultancy or expense fees or payment for technical assistance. rather than in monetary payments as royalties or fixed fees subject to taxation. Wilson(2) suggests that licensors typically obtain 25% of the total profit obtained by the exploitation of a licence.

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1. Contractor F J. op.cit. Contractor suggests a potential return of 4500% and this is supported by the empirical work reported below.

2. Wilson, R W. op.cit.

It *is* clear that in some cases licensing can be extremely profitable to individual firms.(1) In the case of Pilkington Glass a relatively small firm in world terms, licence income was almost as important as trading profit in the success of the company between 1979/80 and 1983/84.

A detailed investigation of the profitability of licensing as it relates to the small firm sector lies outside the scope of this thesis. This subject was investigated as part of the empirical studies under the Leverhulme project.(2) This study suggested that the decision to utilise outward licensing in smaller firms usually occurred following development of a successful product rather than as part of a planned strategy prior to that product's development. Returns accruing to such products as a percentage of transaction costs could be high, averaging more than two hundred per cent.

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1. See for example Pilkington Bros plc. Report and Financial Statements Year ended 31.3.84. Licensing income over a five year period was recorded as:

	1980	1981	1982	1983	1984
Sales £m	629	787	959	1022	1214
Trading Profit £m	49	48	27	41	77
Licence income £m	37	35	39	28	24

2. Lowe J and Crawford N K. 'Outward Licensing as a Marketing Strategy - An Analysis of Returns' Paper presented at Conference on Technology Licensing, Bath University, May 1983.

H. LARGE AND SMALL FIRM LICENSING

It was suggested above that multinational and other large firms may consider the licensing option as a matter of course in their policy, strategic and tactical decision making. Licensing departments staffed with licensing executives and patent lawyers can provide for such firms a pool of experience that is a continuing resource. Continuing consideration of the licensing option *per se* is therefore probably part of the ethos and culture of many such firms. Licensing departments are probably necessary for large conglomerate or multinational concerns transferring intellectual property both within and outside their organisations.(1) Smaller firms, however, probably frequently have little prior experience of licensing and therefore little 'in-house' expertise. They may therefore have difficulty in identifying suitable skills to call upon in the negotiation of licence agreements. The process by which such firms decide to utilise licensing is explored in some depth in the following chapter, with particular reference to its role in strategies of diversification. Few studies appear to have been undertaken in the past into the use of the licensing option by smaller firms.

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1. Indeed, receipts for related (i.e. inter-firm) transfers accounted for more than 50% of receipts and 80% of expenditures on royalties in the Uk in 1979 and this would indicate that larger firms carry out the majority of licensing activity. Source - British Business 12.6.81.

Differentiation of the rationale, utilisation and process of licensing in larger and smaller firms is probably important in defining the special problems and advantages that impinge on such firms. Differences between large and small firms in licensing policy can be considered under two headings - Policy Factors and Information Provision and Resource Availability.

1. Policy Factors

A major objective of many smaller firms has already been suggested to be survival and independence[1], with profit maximisation as a secondary objective. Larger firms probably have different priorities based in part upon their different stakeholder profiles While profit maximisation is clearly an objective in larger firms, it is possible that the maximisation of managerial remuneration and position may be an equally important factor in understanding the rationales of large company management. This factor may also be important in understanding the different licensing objectives of large and small firms. While small firm managements might perceive such agreements as reducing control of their technology portfolios, larger firm management might see licensing (particularly 'cross-licensing') as a method of increasing the 'robustness' of their firms against outside pressures.

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1. See Chapter 2.

2. Information Provision and Resource Availability

Many larger firms have licensing departments devoted solely to the exploitation of their technology portfolios,and the transfer of technology into and out of the organisation. Such departments provide the resources to carry out licensing that may not be available in the smaller firm, with its concentration of functions in a smaller number of individuals. Within the larger firm, therefore, technology licensing may be considered as normal practice. In smaller firms this may not always be the case.

The presence of a licensing department probably stimulates the use of the technique within larger firms. The opportunity cost of technology licensing may also be higher in small than in large firms. This might suggest that agreements between large and small firms could be beneficial to both parties in exploiting the legal and licensing skills of the larger firms in transferring technological skills to and from smaller firms.[1] However, the evidence suggests that such transfers can be problematical in some cases.

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1. Lowe J and Crawford, N.K. Licensing Between Large and Small Firms. Les Nouvelles (Journal of the Licensing Society) March 1983.

I. CONCLUSION

It has been a major objective within this chapter to review the strategic and economic role that technology licensing can play in the product and market development policies of all firms. The factors that might cause smaller firms to consider and use licensing are explored in Chapter 6. It is clear that technology licensing is an important area of economic activity that has, possibly, not received sufficient attention in the literature. Statistics defining the volume of resource flows pertaining to its use are therefore either lacking in detail, incomplete or are subsumed within other statistical data.

The majority of licensing is clearly carried out by larger companies, often transferring technology between divisions within the firm, but across national boundaries in many cases. In the context of this thesis, such transfers are only directly relevant in a consideration of developing knowledge of licensing techniques. Since the skills of individuals play a large part in successful licensing, the effect of large firm licensing in increasing those skill levels may be important in promoting the use of licensing amongst smaller firms. Technologies may be licensed out from larger companies, while personnel may change employment from large to smaller concerns.

The scope of technology licensing has been shown to encompass a wide variety of industries. Many of these are the 'high technology' research intensive industries where licensing can be used to exploit technical advantage without the need to enter markets directly, through export. It is suggested that such licensing can be used to overcome tariff barriers. It is also clear however, that much licensing is not in the high technology industries, and this may be important in defining the strategic role that licensing can play. Export of intellectual property to third world countries endeavouring to raise their levels of technological expertise may account for many such transfers where obsolescent or labour intensive techniques are transferred.

The scale of technology licensing both amongst small and large firms may be growing. As communication methods increase in effectiveness and levels of competition increase, it might be anticipated that the scale of technology licensing might also grow as companies used licensing and cross-licensing agreements as a strategic tool to compete on an international scale. In some industries, where process licensing is important, such as pharmaceuticals, it appears that this situation has already been reached. Larger firms may seek to exploit markets dominated by strongly entrenched competitors by co-operating with them through cross-licensing arrangements.

A further rationale for the use of licensing, particularly amongst smaller firms, may be the increasing cost of surmounting threshold levels of research and development. Licensing may extend the ability of such firms to compete in markets through the introduction of products that could not be developed 'in-house' because of resource limitations. This would also suggest increased co-operation amongst firms in areas beyond licensing such as co-operative research and development programmes[1] prior to product commercialisation. Such development suggests that the most suitable way of considering licensing is as a strategic tool, conferring enhanced flexibility and a competitive advantage to the firm in some cases. It is to the issues that surround strategic licensing in <u>smaller</u> firms that the following chapter is devoted.

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1. As supported for example through the ALVEY scheme in the UK and ESPRIT scheme in the EEC in collaborative advanced computer development.

CHAPTER 6

TECHNOLOGY LICENSING AND STRATEGIC PRODUCT PLANNING IN SMALL MANUFACTURING COMPANIES

A INTRODUCTION

The first part of this thesis considered the small firm under the headings of 'Business Policy', 'Diversification' and 'Technological Change'. The major objective of the analyses carried out in these sections was to build a base upon which the utilisation of technology licensing (TL) could be considered.

Part II of the thesis is divided into two parts. First, an exploration was made in Chapter Five of Technology Licensing *per se.* It is the objective of this chapter to draw information from the preceding work in a consideration of the strategic issues impinging upon the utilisation of TL within smaller firms. The chapter is structured around an initial evaluation and summary of the factors that might affect the development of product and market strategies within small firms and the relationship these factors might have to the use of TL.

Various hypotheses evolve from earlier work reported on in the thesis and a preliminary examination of some early case studies of TL. Further empirical work to test these hypotheses was carried out through case studies of the remainder of a forty case sample. These were small and medium sized firms which had utilised inward or outward TL in their new product and market development. The empirical studies consider whether larger numbers of small manufacturing firms could utilise TL and endeavour to identify those practical barriers that might prevent them from doing so in the context of the hypotheses generated below.

B TECHNOLOGY LICENSING AND SMALL FIRMS (Some Evolving Hypotheses

What are the factors that suggest the use of TL over other forms of market realisation for small firms? Identification of such factors and exploration of the development of a business and technology strategy integrating the use of TL is considered below.

It was suggested in Chapter Two, that one of the major competitive advantages of smaller firms was an ability to react quickly to environmental changes. Such flexibility might be a function of size, and, possibly, lower capital intensity. This might lead to the potential for resources to be reallocated from one activity to another quickly. Flexibility was also suggested to encompass the faster integration of techniques and hence TL might be anticipated, in principle, to be quickly accepted by small firms.

It is probably pertinent to consider those issues that might affect the process of strategic decision making through evaluation of internal and external pressures upon the firm. Each pressure is likely to have an effect upon the firm but may also be interconnected with other pressures. Such pressures can be illustrated diagramatically (Figure 6.1 below). It is suggested that certain of the pressures may cause changes within adjacent segments and hence the 'factors' may be interconnected. However, for clarity it is probably relevant to consider them separately here.

In view of the issues raised in previous chapters and the descriptive work therein, it is considered that the 'environment of the firm' can be described in terms of the following factors. Internal pressures encompassing the role of strategic planning; company organisation; company culture; product profiles and technological skills. External pressures include market constraints and opportunities; forms of competition; the availability of 'venture' funding; societal and cultural factors and lastly, government policy. It is suggested that any stimulus to the utilisation of TL may arise from one and be affected by several of these factors.

The 'segments' of the diagram are considered below. In view of the substantial descriptive and empirical work in previous chapters which is also covered by the headings here, references are made to these chapters where necessary, to avoid repetition within the text, as is reference to previous evidence upon which hypotheses are also based. The hypotheses were derived through a process of induction from the theoretical and empirical work described in previous chapters, and deduction from the evidence of a small number of preliminary case studies[1] but tested against a previously untouched sample of cases.

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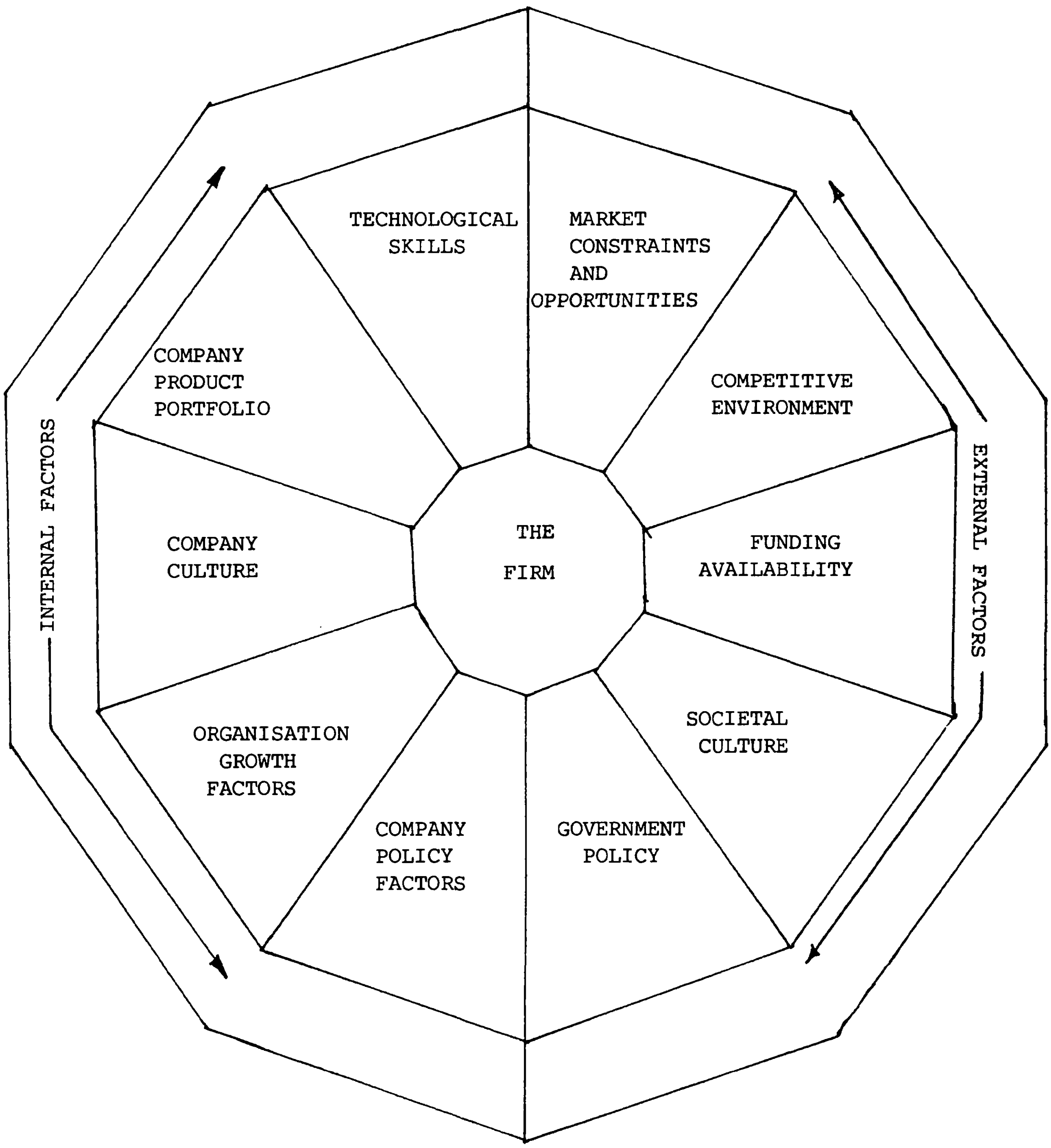
1. See page 314

Figure 6.1

Factors Impinging upon Product Policy and the Use of Licensing in the Small Firm



1. Internal Considerations

Since smaller firms are likely, because of their size, to be less 'functionally specialised' than larger firms, it is unlikely that a majority of such firms would have a 'licensing manager.' This might suggest the lack of a previous culture of TL within the firm. Licensing might therefore, only be used if it was triggered [1] by a stimulus arising from outside or within the firm. Such a trigger signal could arise as a perception that new products were required or through pressures to change organisational activity.[2] A possible framework for modelling this process is suggested in Figure 6.5 below (Licensing Trigger Signals). Internally founded signals could arise from the following sources.

(a) Strategic Planning

It was suggested above[3] that many smaller firms develop product and market strategies in a relatively unplanned manner. Such strategies may frequently arise as a reaction to rather than in anticipation of events.[4] In the utilisation of TL,

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1. Thomas, R.E. Business Policy, op.cit.
2. See for example Norburn, D and Grinyer, P. '<u>Directors without Direction</u>'. Journal of General Management, Vol.1 No. 2, 1973/74
3. Chapter 2
4. Johnson G and Scholes K, op.cit.
   The authors suggest that "it is highly unlikely that sophisticated strategic models will be used in small companies where less time consuming approaches may prove valuable."

purchase or sale of technology might indicate a willingness on the part of management to relinquish some control over either its product line development (in the case of purchase) or its market development (in the case of sale). Clearly, such development could arise as a result of recognition by management that it did not possess the resources effectively to carry out such functions 'in-house'. Alternatively, the use of TL might arise as the result of an ad hoc event or from impetuses arising from the organisational or cultural type of the firm. Consideration of the work carried out in Chapters 2 and 3 above, suggested that many smaller firms approached policy formulation in a relatively unstructured manner, but that a smaller sub-set had developed into new, diversified product/market areas as the result of more positive decision taking.

If progressive small firms had diversified and developed new products proactively, it is relevant to consider if equivalent use had been made of TL. The first of the hypotheses to be tested here can therefore be expressed as:-

'Technology Licensing is used Proactively by many Small Firms in their New Product/Market Development Strategies.'

(b) Company Organisation and Growth Factors

The quality and structure of the organisation of any small company is likely to be defined by both company history and objectives of current Directors. The organisational structure may be an important factor in the successful introduction of new ideas, techniques or development into new areas of expertise. Attempts to change from traditional to radically new strategies may be resisted if sufficiently strong 'coalitions of interest' exist within the firm.[1]

The organisational structures of many smaller firms may reflect such pressures. However, in the case of owner managed companies, such pressures might be less powerful. However, in such cases, failure to develop from an autocratic to a more delegated management structure may also inhibit growth.[2][3] Introduction of new techniques, such as the use of TL, may therefore also be affected by internal organisational structures.

Organisational development may frequently lag behind the growth in company size, particularly in fast growth companies. In such instances ineffective organisational structures could become a constraint upon the development of the company. This could occur at the change from 'small' to 'medium' size. TL might

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1. See for example Cyert R and March J. '<u>A Behavioural Theory of the Firm</u> Prentice Hall, 1963

2. Johnson and Scholes, op.cit.

3. Curran J and Stanworth J. <u>'The Way of the Small Businessman</u>' New Society, August 1971
The authors suggest that some small firms become 'frozen' at a particular size because of lack of management skills and a disinclination by owner managers to delegate.

have a role to play here, in assisting small firms to break through growth barriers by reducing the amount of management resources that might have to be expended on the development of a new product or market. By utilising TL effectively to sub-contract the development or export functions, smaller firms might be able to overcome such barriers. Inward licensing, by providing, in principle, more resources per unit of Research and Development expenditure, could lead to more 'complex' products being developed. Conversely outward licensing, by allowing more effective exploitation of current product lines might also allow turnover related to those products to increase. Thus TL could be seen as a resource conservation process. Clearly, this would also have implications in assisting the firm to obtain products or enter markets that it would otherwise be unable to exploit. This leads to a second hypothesis, that:-

Technology Licensing Assists Small Firms in Overcoming Managerial and Technological Threshold Barriers.[1]

(c) Cultural Factors

Describing and understanding organisational behaviour and investigating the 'culture' of the firm appears to be assuming a greater importance in attempts to understand the development

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1. See also 'e' 'Technological Skills' below

processes of firms than hitherto.[1] To an extent, such a change in emphasis builds upon earlier work in the field.[2] Company 'culture' may be an important factor in the use or non-use of TL by small firms. Clearly, the use of technology licensed 'in' from outside or licensed 'out' to others, suggests a willingness on the part of management to accept outside influences in the development of its business. Clearly some firms do have 'cultures' more accesible to outside influences than others: hence previous classifications of firms as 'parochial', 'progressive' or 'adaptive' [3] or as thrusters and sleepers.[4]

Introduction of new techniques such as the use of TL could, therefore, arise in response to the recruitment of particular individuals, changing the culture of the firm. Conversely, the introduction of new technology through the use of Tl or other techniques could itself have a powerful effect upon the firm's culture[5] as old demarcation lines for particular functional

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1. See for example,
   Miles, R E & Snow, C.C. '<u>Organizational Strategy Structure and Process.</u> McGraw Hill, 1978

   Berry, D. '<u>The Perils of Trying to Change Corporate Culture'</u> Financial Times, 14.12.83

2. See for example, Cyert R and March J. <u>'A Behavioural Theory of the Firm'</u> op.cit.

3. Carter, S.F. and Williams, B.R. <u>Industry and Technical Progress</u> Oxford University Press, 1957

4. Political and Economic Planning '<u>Attitudes in British Industry</u>' Penguin Books, 1956

5. See for example Heller, F.A. 'Financial Times' letter 5.9.83

activities within the firm changed. Resistance to such change might, in the case of TL, manifest itself as the Not Invented Here (NIH) effect.[1]

(d) Product Portfolio Factors

The balance of products within product portfolios can clearly cause important pressures for strategic change within smaller firms, as can the type of industry within which that firm is operating. A high level of technological innovation within particular industries may lead to pressures at the company level, to innovate, diversify or change the balance of current product portfolios. Where licensing is used within an industry as a matter of course[2] this may lead the firm to consider it at an early stage in its development.

Product portfolios can be analysed, as suggested in Chapter 2, through a consideration of the cash inputs and outputs accruing to particular products.[3] However, a consideration of the product and technology life cycles in conjunction with such an analysis may also provide a particularly useful framework in any consideration of the use of inward or outward licensing by smaller firms. The cash flow implications of utilising inward and outward licensing can be demonstrated diagrammatically, as

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1. See for example - Purkis, A '<u>Observations on Understanding and Absorbing New Technology</u>'. Paper given at conference on Buying and Selling Technology. Bath University, 9.83

2. The extent and use of TL varies widely between industries. See for example Davies H and Rosser N. '<u>International Trade in Technology - A Survey</u>' op.cit.

3. Boston Consulting Group. op.cit. Chapter 2

in the two Cost Revenue Models below. (Figures 6.2 and 6.3).

The first Cost Revenue Model suggests that the cash flow implications of inward licensing can be highly positive, early in the product development cycle. However, a penalty is paid later as royalty levels increase with sales of the product.[1] The implication of the first cost revenue model is that inward TL can lead to reductions in Research and Development Costs, an improvement in Cash flows and to the faster introduction of new products. This might suggest that TL could assist small firms to diversify into new areas, particularly where resource constraints existed.

Outward licensing, as modelled in the second Cost Revenue Model, could occur at one of up to six points, as an idea, prototype, pre-production or production model or during the growth or decline of that product.[2] At each of these points the potential revenue from TL might be anticipated to increase. However, the potential revenue from 'in-house' manufacturing and marketing might also be anticipated to increase.

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1. It is suggested that it might be illuminating to compare discounted cash flows for paired samples of inward licensed and 'in-house' developed products. This has not been attempted here however.

2. Possibly paralleling 'Research and Development', 'Star' 'Problem', 'Cash Cow' and 'Dog' under the Boston classification as explored in Chapter 2.

Figure 6.2 Cash Flow Implications of Inward Licensing

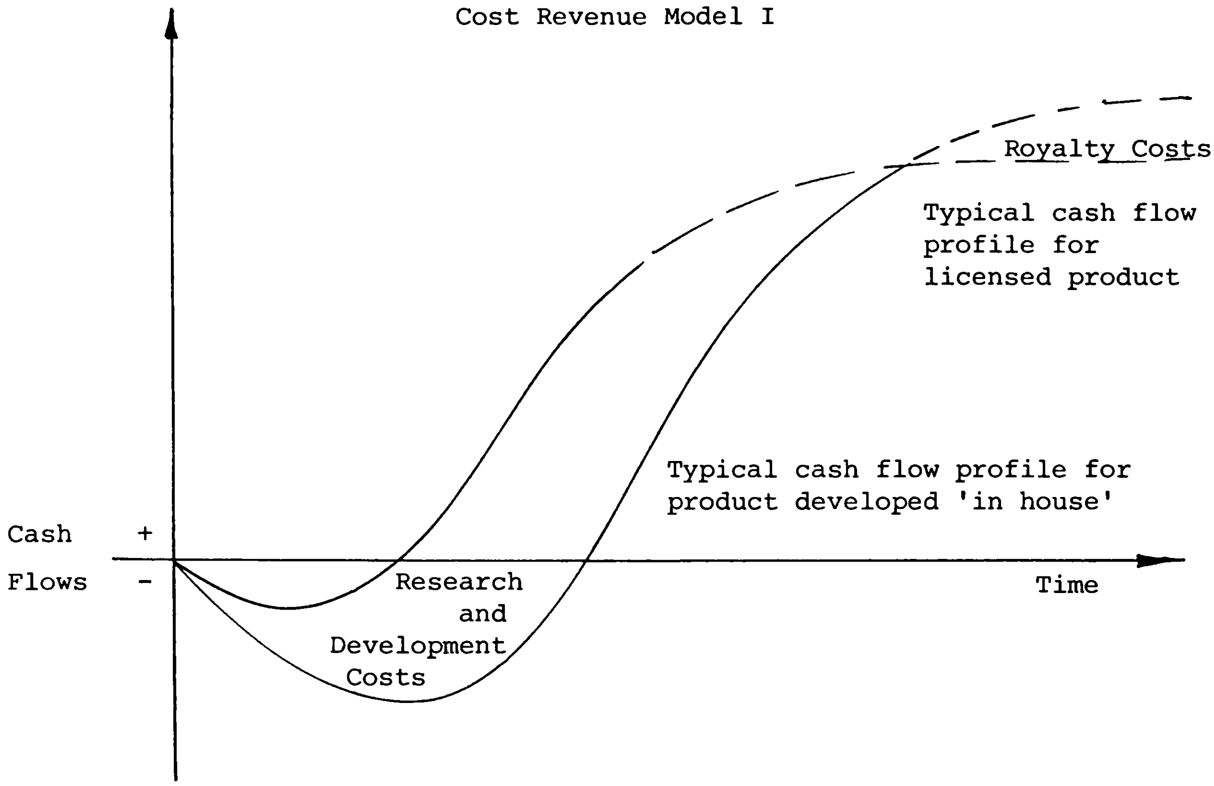
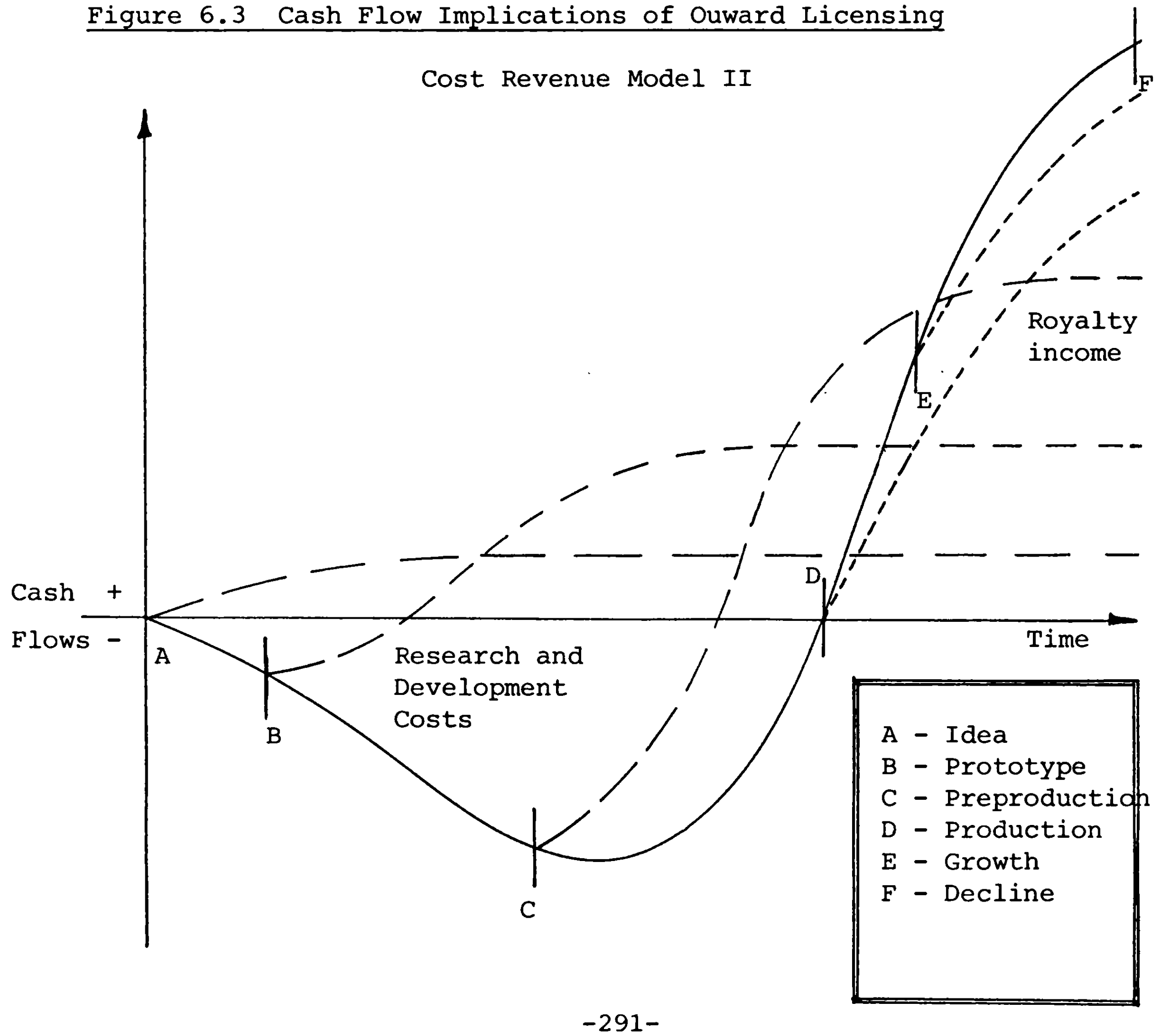


Figure 6.3 Cash Flow Implications of Ouward Licensing



The second Cost Revenue Model suggests that licensing 'out' might be attractive if both manufacture in home markets and licensing out to other markets could be achieved simultaneously. The model suggests that if research and development costs become too high for continued support, a return could still be achieved from that product through licensing. It is therefore pertinent to consider the pressures upon a smaller firm to out-license at each of the 'decision points' A-F in the second model.

Licensing a product idea 'out' might occur because the 'idea' did not fit in with current or potential skills, or because the costs of development and manufacture were considered too high. Without patent protection however, an 'idea' would be likely to be relatively valueless. However, once patented and produced in prototype, the product would be likely to become a more valuable intellectual property. Licensing 'out' could then be attractive as a means of obtaining a return on development costs. The same situation could apply both to the pre-production and production stages of the product. High production or marketing costs might force the small licensor to consider selling his technology. Once again, any buyer would be effectively purchasing the sunk R & D resources that had been expended on that product.

At the 'production' and growth stages (D and E), the attractions of licensing out in home markets would be low, since these stages correspond to the 'star' and 'cash cow' classifications under the Boston terminology. However, since the product would then have a 'track record' the potential for licensing 'out' into other markets may increase. The licensor may, therefore, be able to seek a higher price for his technology. In the final or decline stage, the licensor may once again find difficulty in finding potential licensees.

One implication of the two Cost Revenue Models is that smaller firms might utilise TL to enter new home markets with products licensed 'in' from abroad, and to exploit overseas markets with current products licensed 'out'. By utilising cash flows from successful products to cross subsidise such developments, the smaller firms could, in principle, develop strategies to develop their markets utilising TL.

Consideration of the Cost Revenue Models therefore suggests a third hypothesis, that:-

<u>Technology Licensing Allows Small Firms to Obtain Products and Enter New Markets at Lower Cost and Reduced Risk than through other forms of Development</u>.

The hypothesis is also suggested by the observation in Chapter 3 (Diversification), that some small firms do enter new markets as they grow in size, and that this process may also occur more in small than medium or larger firms.[1] Clearly, if the <u>costs</u> of entering new markets could be reduced this would be

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1. See also Hankinson, A. 'Investment Behaviour of Small Firms.' op.cit.

likely to be advantageous to smaller firms intent upon a growth strategy through product development, but restricted by resource constraints.

(e) Technological Skills

In previous chapters it was suggested that lack of resources might prevent small firms capitalising on strengths in inventing new products. Such resource constraints might also prevent some smaller firms from developing balanced product portfolios. However, within narrowly defined technological areas, smaller firms may be able to build high levels of skills. In endeavouring to compete with larger firms in wider markets, the high cost of achieving threshold research expenditures might preclude such firms from effective competition.(1) Thus some smaller firms might have no option but retreat from such technological thresholds unless means could be found to overcome them.(2)

Purchase of technology through inward licensing might provide smaller firms with a method of overcoming threshold barriers through the avoidance or reduction of development costs. Thus smaller firms with limited Research and Development facilities might be able to obtain products through TL that they would be unable to develop themselves. The suggestion that small firms do utilise TL in this manner is explored in the second hypothesis (above).

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1. Steed, G op.cit.

2. See Chapter 4

2. External Considerations

The 'external environment' can also probably be viewed as a series of stimuli impinging upon the firm. In Chapter 2, it was suggested that such external stimuli may have a greater effect on smaller than larger firms. While larger firms may be able to exert certain quasi-monopolist pressures upon the environment, in the case of smaller firms this may only be true for very small market niches. Environmental effects may be difficult to describe or measure. However, consideration of external factors is likely to be important in developing successful strategies. It has been suggested that environmental factors can be modelled within a framework of 'competitive rivalry'.(1) This suggests that many external stimuli arise from competitors or from sources that may become competitors.

An understanding of the response that competitors will make to any decision to utilise TL is likely to be an important factor in making that decision. Indeed, undertaking inward licensing could be a means for entering a market more quickly than a potential competitor or reacting quickly to the introduction of a product by that competitor. In the context of such considerations, the Competitor Analysis Model reproduced below is particularly useful in considering TL. While larger firms

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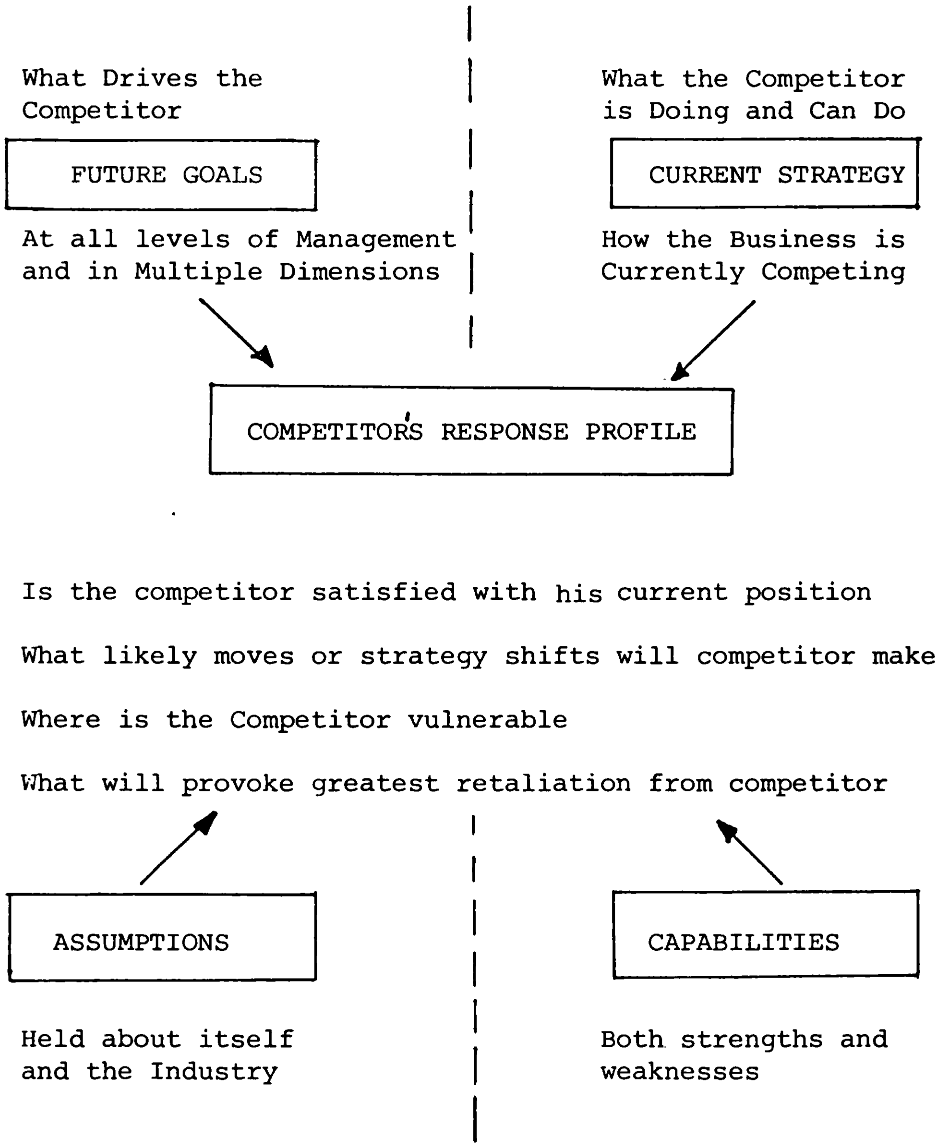
1. Porter, M.E. 'Competitive Strategy'. The Free Press, 1980
   See the 'Competitor Analysis Model' below.

Figure 6.4 The Competitor Analysis Model [1]



1. This model is reproduced from Porter, M.E. op.cit.

might be prepared initially to sacrifice profitability to increase market share,[1][2] smaller firms would be unlikely to be able to follow this strategy. Hence information on the intentions of larger potential competitors could be crucial in the licensing decision.

While competitive rivalry is clearly important in the decision to utilise TL, other environmental factors may also impinge upon this decision. These are now explored under the headings of Market Constraints; Forms of Competition; Funding Availability; Societal and Cultural Factors, and the potential impact of Government Policy.

(a) Market Constraints and Opportunities

It was postulated in Chapter 2 that some small firms may be able to survive through exploitation of comparative advantage in developing expertise in small market areas. In such 'market niches' smaller firms may be able to become dominant suppliers. Porter[3] suggests that this strategy may be a key factor in overcoming competitive pressures. Identification of suitable market niches in which to concentrate could be crucial however, and the number of such niches might be limited.

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1. See for example, Buzzel, R.D, Gale, B.T. and Sultan, R.G.M. 'Market Share - A key to Profitability'. Harvard Business Review, Jan/Feb 1975

2. Boston Consulting Group, op.cit.

3. Porter, M.E. op.cit.

Diversification into other small market niches might be restricted by entry barriers which could include lack of technological expertise or the market strength of already existing suppliers. However, TL might offer a means of exploiting such niches, particularly in the case of inward licensing. Licensors might be prepared to subsidise their licensees to break into such markets. New technological developments might also facilitate entry to such niches in some instances.

(b) Forms of Competition

Two methods of exploiting markets by small firms were considered in Chapter Four. These were described as development of technology for small niches, and competition through concentration of marketing and other skills. In the former instance entry by larger firms might be unattractive in view of the small size of the market. In the latter case, competition might be based upon enhanced flexibility and service based skills.

Porter [1] suggests that five competitive forces may exist within a market. Namely - Entry; Threat of Substitution; Buyers' Bargaining Power; Suppliers' Bargainining Power; and Current Competitor Rivalry (explored briefly above). The potential for entry to new markets by smaller firms was suggested to be restricted by development cost factors and high threshold R & D levels. However, other factors may also apply. The 'expertise' of companies operating within the market may preclude entry by competitors as modelled

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1. Porter, M.E. op.cit.

in the 'Experience Curve' in Chapter Two. However, such 'experience' could become a disadvantage if technological development led to substitute products' becoming available. Such substitution might provide a smaller firm with the opportunity to attack a new market niche.

The threat of substitution for firms within market niches may be more crucial for smaller than larger firms. The latter might be able to devote larger resources to prolonging product lines. However, smaller firms might be anticipated to be able to react more quickly once such a threat had been identified. In such instances inward TL could be a potential tool in assisting such firms to launch new products quickly.

While suppliers' and buyers' bargaining power may affect the decision by smaller firms to enter new or leave old markets, such factors are probably unlikely to impinge upon any decision to utilise TL per se. Possibly more relevant to such a decision would be the state of current competitor rivalry within current markets and in markets under consideration for entry. Cross-licensing agreements between potential rivals within particular industries may have the effect of reducing such competition in some instances.(1) In other industries, competition from outside particular geographical areas may be reduced because short product

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1. See for example, Contractor, F. International Technology Licensing. op.cit.

life cycles or high transport costs mitigate against direct export.[1] Such factors might be anticipated to lead to an increase in TL levels.

(c) Availability of 'Venture' Funding

One corollary to the availability of funds for development purposes within the firm is the availability of external 'venture' funding. Clearly, in those cultures where ample funds and potential investors are available for the development of new products/technologies, the potential for small firms to diversify into new areas through 'in-house' development may be high. Conversely, if development funds were difficult to obtain, smaller firms might be forced to consider obtaining new technology through the use of TL or other joint ventures if they wished to enter new markets. However, availability of funding suggests a matching demand for that funding. Several commentators have highlighted the reluctance of some smaller firms in raising venture capital from outside sources where this involves sale of equity.[2] In some instances the use of TL might overcome such objections. It is suggested therefore, that low availability of venture funding could be a factor in the decision by some smaller firms to utilise TL.

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1. As explored in Chapter Five

2. See for example, Boswell, J. 'The Rise and Decline of Small Firms' George Allen and Unwin, 1973

(d) Societal and Cultural Factors

While funding availability could be one constraining factor in all new product development, societal and cultural factors may also have an effect upon such decisions.[1] Technology licensing may be affected by such factors at both licensor source and licensee destination. While larger firms may be able to devote sufficient resources to overcome societal/cultural problems in TL, it seems likely that smaller firms may find it more difficult to overcome them. Translation costs, expenditures on product redesign and different national standards may impose severe barriers to simple technology licensing. This might suggest that TL in smaller firms would be most likely to be carried out between companies in their own markets, or to/from markets where there was a high degree of cultural affinity. This leads, therefore, to a fourth hypothesis, that:-

Cultural and Societal Differences Restrict Licensing Agreements between Small Firms in Different Cultures.[2]

The hypothesis is also suggested by consideration of the opportunity costs involved in carrying out the TL function. It is suggested that this may be higher for small than for large firms. As the

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1. See for example, Hofstede, G. 'Cultures Consequences' Sage Publications, 1980.
   Hofstede concludes that cultural differences affect employee motivation, management style and organisational structure.

2. The 'culture variable' used here was use of the English Language.

complexity of the new task (such as TL) increased, the propensity of the small firm to carry out that task might be anticipated to be reduced.

(e) Government Policy

Government policy on the use of TL varies widely. Particular countries, such as Japan, have utilised inward TL in a highly proactive manner [(1)] to develop indigenous industry. Other countries have acted to restrict the inward flow of technology as a means of retaining, or restricting, outflows of foreign currency. [(2)]

Many governments appear to view TL, particularly multinational cross licensing, in an unfavourable light, as reducing competition and restricting trade. Agreement through the EEC or other bodies to outlaw market sharing agreements may also reduce the attractiveness of TL for smaller firms. Fear of setting up competitors might, in these instances, militate against the sale of technology, particularly to companies in adjacent markets, unless restrictions of licensees to particular markets could be made.

However, the value of TL to smaller firms also appears to be

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1. See for example Mifune, R 'R & D and Licensing in Japan' Les Nouvelles, June 1978

2. India for example

recognised, particularly by the EEC.[1] Government policy can probably therefore, have an important effect upon the volume and success of TL by smaller firms.

The rationale for inward and outward international licensing _per se_ was explored in detail in Chapter Five. It seems clear, that governments have regarded international TL mainly in the context of the multinational firm when drafting legislation in this area. The effects of such legislation on the smaller firm do not always appear to have been considered.

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1. See for example _'Grants from Europe for Small Firms'_. Department of Trade and Industry 1984. This scheme utilises European funding to support inward and cross TL by small firms.

C. MODELLING THE LICENSING PROCESS IN SMALL FIRMS

Having considered the influences affecting any decision to utilise TL in smaller firms, it is also pertinent to attenpt to model the result of those influences in practice. It is suggested that there are three areas which could be modelled in this way. First, the factors that might lead to a smaller firm reaching a decision to utilise TL as an alternative to other forms of development. Second, consideration of the factors that might facilitate or provide barriers to the utilisation of TL. Third, consideration of TL at the product level, within the firm, and in relation to both existing and potentially new products.

1. Licensing Trigger Signals

Some of the internal and external factors and forces impinging upon the licensing decision have been explored above: in particular the trigger signals[(1)] which may initiate any decision to utilise TL. If a company is considered as an organisational system, open to both internal and external pressures as suggested in the 'wheel' diagram above, recognition of a new product need, might arise fromeither of these sources. Development of appropriate responses to trigger signals might then be considered

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1. Thomas, R.E. Business Policy, Philip Allan Publishers, 1977

   A trigger is defined as an 'event which does not conform to expectations.'

in the light of the strengths, weaknesses, opportunities and threats affecting the firm at that time.

Threats and opportunities may be more likely to arise as external factors affecting the firm, while strengths and weaknesses clearly relate more to internal factors. Consideration of the potential for TL might, therefore, be seen in the context of the alternative strategies of 'in-house' development or direct export in the cases of inward and outward licensing respectively.

Recognition of a threat or opportunity might suggest that the firm would react by seeking information to define it. In the case of smaller firms, consideration of TL might be from a base of incomplete information[1]. The opportunity cost of obtaining that information might be high, in light of the lower level of functional specialisation in the management of small firms, as suggested above. The Licensing Trigger Model below therefore, suggests a 'multi-stage' process prior to any final decision to utilise TL.

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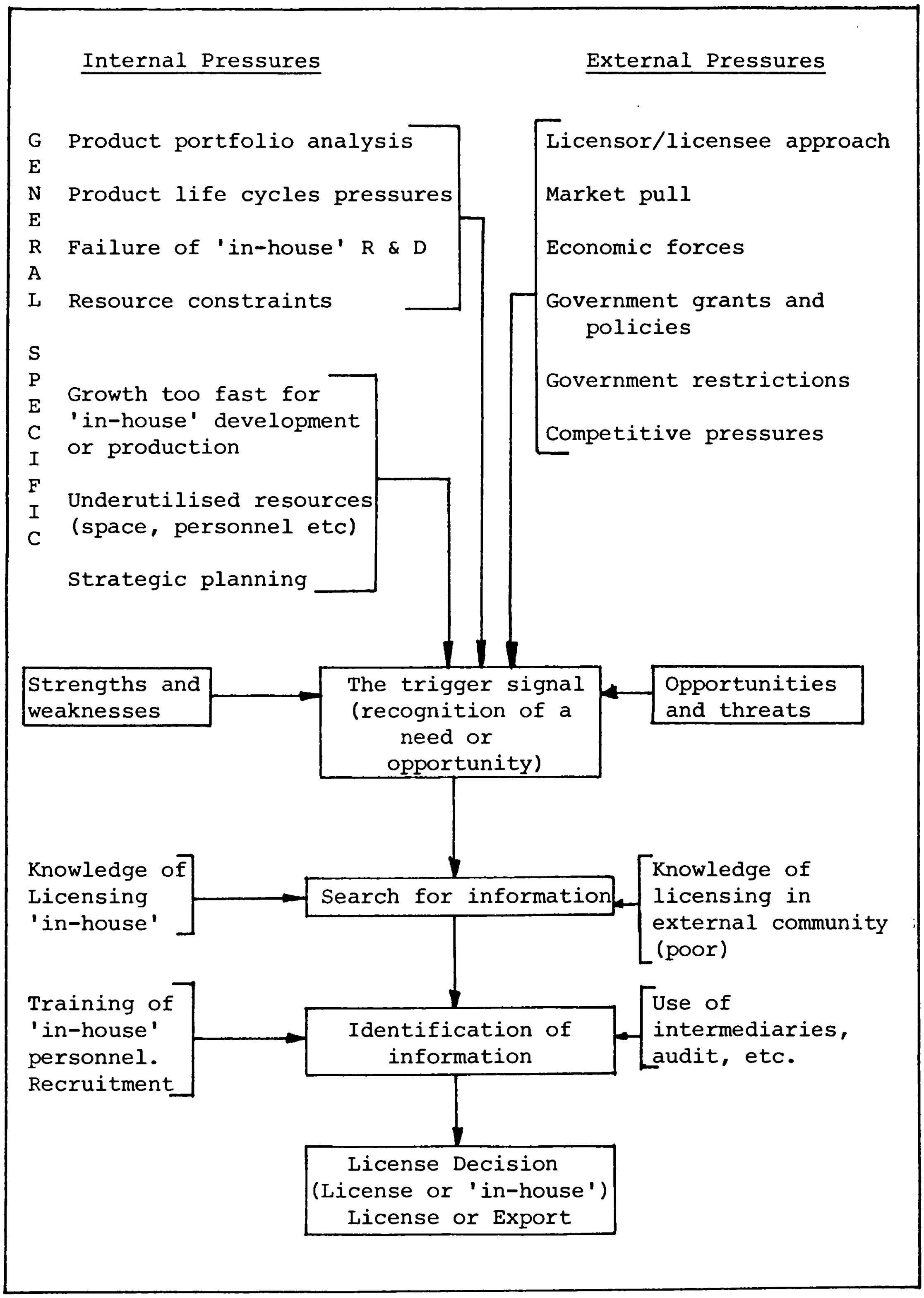
1. Lowe J and Crawford N K. '<u>Technology Licensing and the Growing Firm.</u>' Pergamon Press, 1984.
   The 'Leverhulme' research suggested that many small firms that had utilised licensing had done so only once (particularly in the case of inward licensing).

Figure 6.5 Licensing Trigger Signals



2. The Operation of Licensing Markets

The easy operation of licensing markets might be anticipated to be restricted by the poor and/or incomplete nature of the information available to, and knowledge contained within the firm, of potential licensing opportunities available to it. This might be particularly important to smaller firms unable to devote large resources to exploring potential information sources. Even within narrow industry sectors it might be difficult for small company management to keep track of all new developments. For larger firms, full time licensing departments might provide the necessary 'in-house' expertise. In attempts to diversify into new areas, knowledge of available technology is clearly necessary. As sectors beyond current skills are considered, such knowledge may be less easy to obtain. Where diversification utilising TL is proposed therefore, the small firm may have to seek such knowledge, utilising outside expertise.

It is clear that firms can endeavour to overcome information problems in many ways. Many larger firms employ company librarians or information officers, in addition to full time licensing executives. For smaller firms, such executives may not be cost effective, particularly if only a small number of licences are negotiated. Private consultants offering alternative information sources might be anticipated to be helpful in view of the potential scale economies involved. However, such consultants may be of varying effectiveness.

It is suggested that the operation of licensing markets can be broadly divided into three segments describing the suppliers, facilitators and users of transferred technology. The different sources and roles of each of the parties are examined in the 'Licensing Market Model' diagram below. Clearly, information is a key aspect of TL, and hence contact and knowledge of licensing markets may be crucial in its effective use. It might be anticipated that smaller firms could be at a disadvantage in acquiring such information in view of resource constraints impinging upon them.

An imperfect operation in the flow of information through licensing markets could also be due to the nature of the information sought and offered by potential buyers and sellers.(1) Commercial secrecy could introduce a barrier to the provision of information detailed enough for buyers to evaluate effectively. Conversely, buyers might also be reluctant to make known their interest in acquiring particular new technologies or products in view of competitive rivalry.

Facilitators of the licensing process may also have several objectives. Commercial facilitators clearly have an interest in obtaining fees and commissions which could conflict with the interests of their clients. Non-commercial facilitators however,

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1. See for example Lovell, E.B. 'Licensing, Reasons, Royalties and Dangers' Domestic Licensing Practices, NY 1968

may have less interest in obtaining quick results and may also have other, social objectives[1] which may conflict with some of the objectives of the client firm. The operation of licensing markets, and consideration of the role of buyers, sellers and facilitators is therefore central to the propensity of smaller firms to utilise TL.

3. Licensing in Small Firms - A Decision Model

The factors that might lead to a decision to utilise inward or outward TL as an alternative to other forms of market realisation have been explored in the previous chapter. Construction of a model to consider the implementation of such a strategy is, therefore, important in considering why smaller firms might follow this course. Since smaller firms have less resources to devote to specialisation in particular functions than larger firms, TL might be anticipated to be attractive to them in principle.

The 'Strategic Licensing Model' described in Figure 6.6[2] was developed to endeavour to take account of the various factors impinging upon the firm in reaching a decision to utilise TL. The objective of the model is to suggest a

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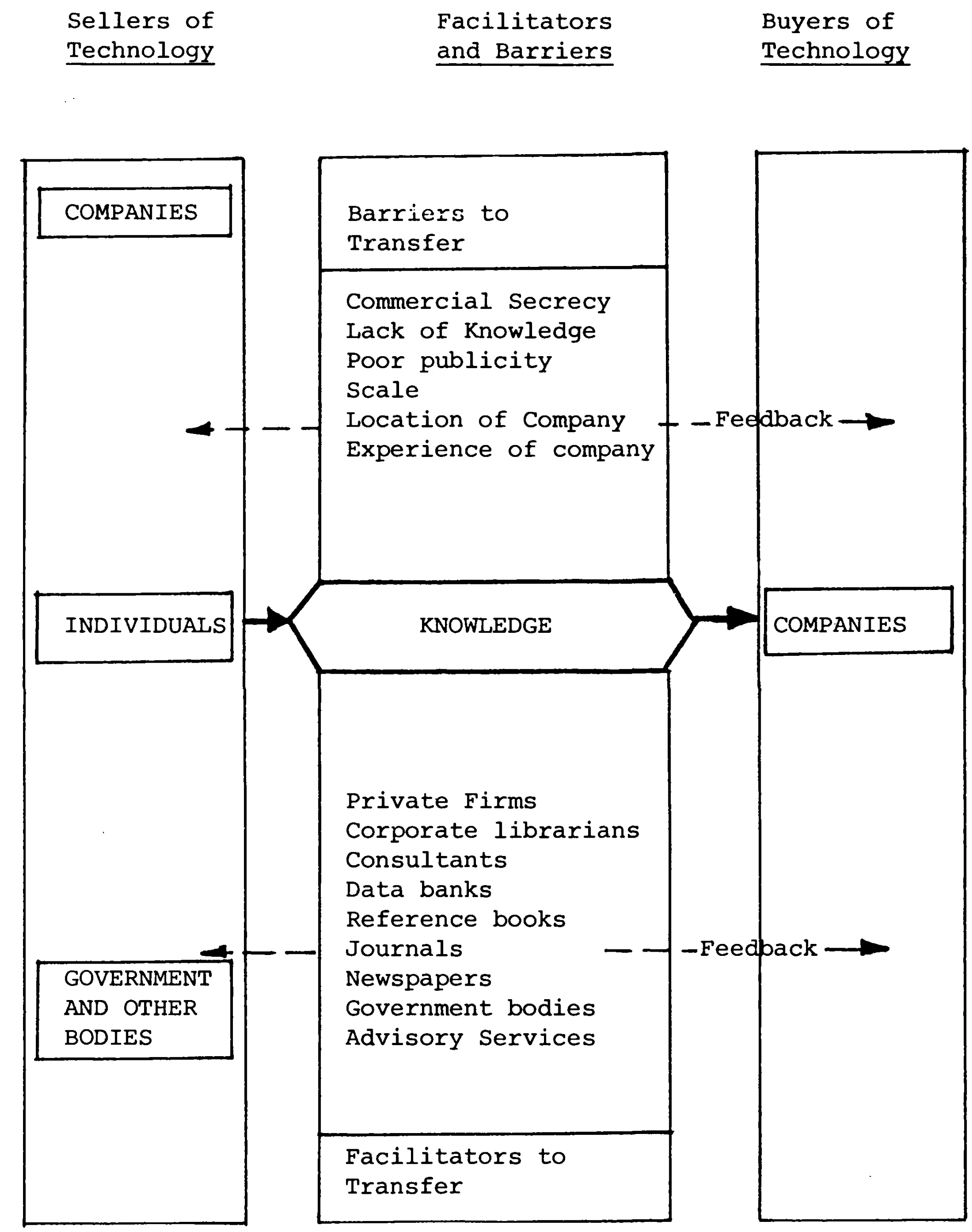
1. For example - job creation, training, etc.

2. The 'Strategic Licensing Model' has been published in amended form in Lowe J and Crawford N K 'Technology Licensing and the Growing Firm' Pergamon Press 1984

Figure 6.6 Licensing Market Model[1]

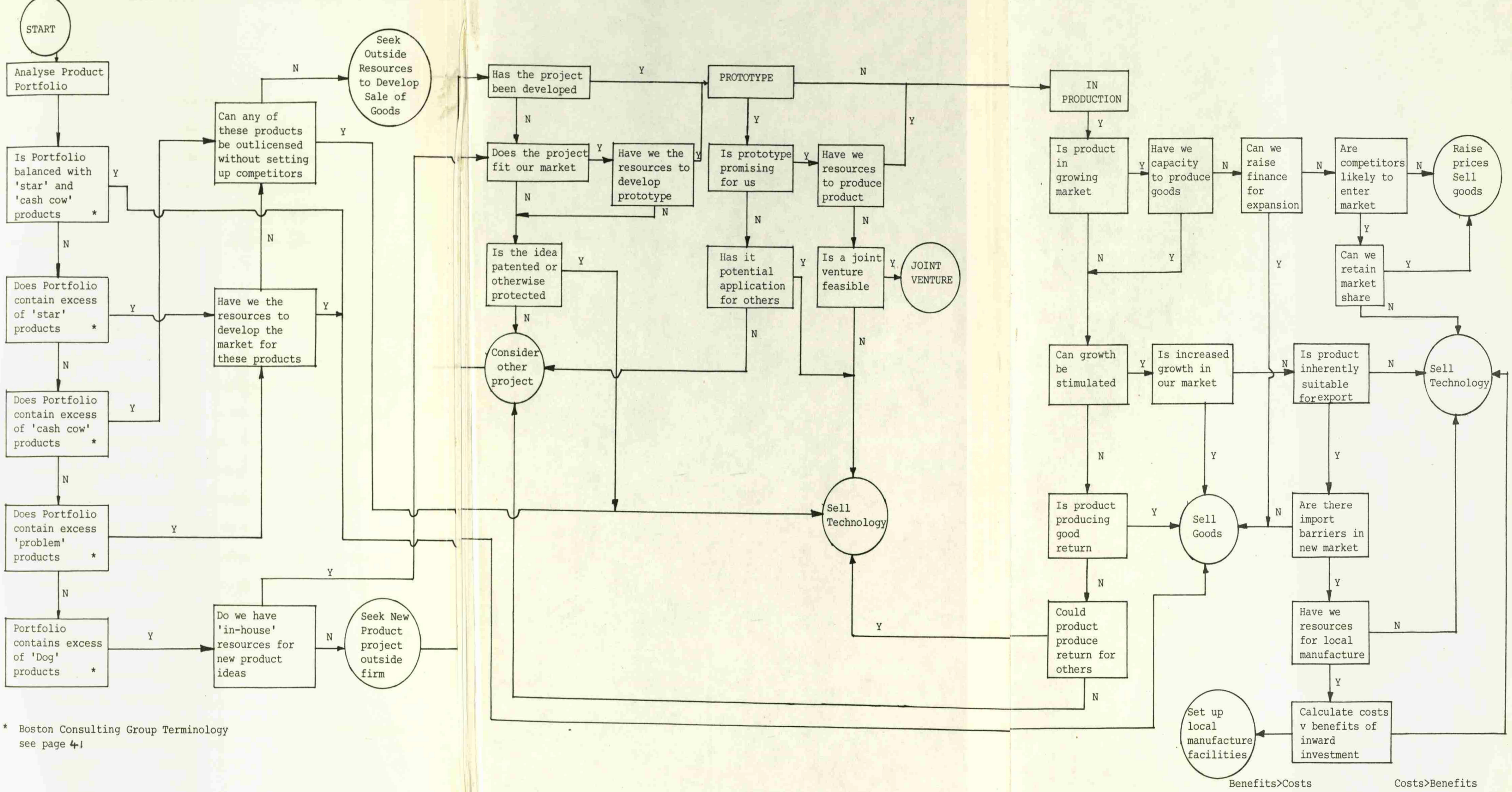


1. The Licensing Market Model has been published in amended form in Lowe J and Crawford N K 'Technology Licensing and the Growing Firm'. Pergamon Press 1984

'decision matrix' whereby potential options can be explored. Consideration of the product portfolio under the Boston Consulting Group (BCG) product classification is made in an attempt to integrate BCG theory into a practical consideration of licensing.

The Strategic Licensing Model may be useful in defining possible alternative strategies for technology exploitation in smaller firms. However, it is clear that its use could not be indiscriminate. The value of this, or any model, is suggested to be in the provision of a framework within which other pertinent information couild be more readily evaluated. Significant 'in-house' and company specific information would be required before the model could be used in practice.

Figure 6.7 Strategic Licensing Model



* Boston Consulting Group Terminology
see page 41

D. THE STRATEGIC LICENSING PROCESS IN SMALL FIRMS - Empirical Evidence

1. Introduction

Following the review in previous sections, of some of the strategic issues involved in smaller firms' utilisation of licensing, and the construction of models to describe this process, it is now an objective to describe the data sources upon which empirical work was carried out within this study. The hypotheses generated above can then be tested against the empirical results.

The empirical work upon which this chapter is based is drawn from several sources. Many of the case studies which make up a majority of the field work, and are used as evidence here, were carried out as part of a research project funded by the Leverhulme Trust.[1] This was a joint study carried out by the author and Julian Lowe and under the direction of the latter. The 'Leverhulme' study was designed to investigate the practical use that smaller manufacturing firms had made of technology licensing.[2] This essentially 'bottom up' approach to the use of licensing in smaller firms is contrasted to the approach here where TL has been considered from a Business Policy perspective. This more 'top down' approach considers TL as part of the strategic decision making process in smaller firms.

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1. See Chapter 1. Introduction

2. The results of this research are reported in the several papers and book chapters referred to below.

Forty small and medium sized companies which had utilised TL were visited in the course of the research and senior executives interviewed. Detailed case studies were written to define the strategic, cultural and organisational factors involved in the decision by case firms to use TL. The case studies and case summaries comprise appendices to this chapter.[1] Other case studies of the use of licensing in smaller firms have been utilised to provide supporting data where applicable.[2] Published data has also been drawn upon where relevant.

2. RESEARCH EVIDENCE

The research evidence utilised in the empirical work carried out for this thesis, and for the studies from which other evidence is drawn was as follows:

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1. Forty cases are examined in detail below. Of these, twenty eight were visited under the 'Leverhulme' project. In sixteen early cases, (denoted by a star against the case number in the appendices) a joint visit was made by the author and Julian Lowe, although all cases in the form presented in this thesis are the work of the author alone. From these early exploratory cases, a crude model of the strategic licensing process in smaller firms was constructed. The author then looked at a further twenty four cases (two of which had previously been published elsewhere and ten of which comprised 'Leverhulme' cases) to test the hypotheses generated above.

2. Notably Svensson, B. '<u>Success and Failure Through Technology Import Through Licensing in Smaller Firms.</u> University of Linkoping (Sweden) 1982

(a) Licensing and the Small Firm (Leverhulme Project)

The empirical work carried out under this programme which is used as supporting evidence in the testing of hypotheses below, was based on the use of intensive questionnaire analysis and structured interviews. The research methodology, data presentation and analyses are described in detail in the papers published as a result of this research[1a][1b][1c][1d] and will not be explored further here.

(b) Case Study Data

The case studies comprise the major fieldwork carried out in the course of the investigation. Initial identification of potential case study companies was problematical because of the apparently small percentage of smaller companies which had carried out technology licensing.[2]

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1. Lowe J and Crawford N K

(a) 'Technology Licensing and the Small and Medium Sized Firm'
European Journal of Small Business, Vol.1, No.4, 1983

(b) Technology Licensing and the Small Firm (Chapter 1)
Gower Press, 1984

(c) Innovation and Technology Transfer for the Growing Firm
Pergamon Press, 1984

(d) New Product Development and Technology Licensing for the Smaller Firm. Industrial Management and Data Systems
July/August 1984

2. Lowe J and Crawford N K. op.cit (a)

A number of sources were therefore used and these included:

- Questionnaire returns from the 'Leverhulme' study
- Companies advertising for or offering products under licence
- Personal contacts with industrialists
- Press and other journal reports
- Companies identified through consultancy work.

The case studies and case summaries comprise appendices to this Chapter.(1)(2)

The initial respondent in the case studies was usually the Managing Director. In as many cases as possible other respondents such as the Technical and Marketing Directors were also interviewed. In order to obtain as much detail as possible, annual reports/accounts, publicity and product promotion literature were obtained where possible. Companies were asked to provide access to their files of correspondence leading to licence agreements. In some cases, copies of these agreements were also obtained. The cases aimed to elucidate the physical characteristics of the firms and the behavioural factors impinging upon them. Exploration was made of why licensing had been used in preference to other forms of product and market development. The course of negotiations and the success of the agreement(s) in the longer term were also explored.

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1. Appendix 6.1 'Inward' Licensing cases A - M
   6.2 'Outward' Licensing cases N - X
   6.3 'Inward and Outward' Licensing cases AA - KA
   6.4 'Random' cases LA - VA

2. Appendix 6.5 Case Study Summary Sheets A - VA

It was considered that face to face interviews would be more likely to elucidate behavioural factors than questionnaire data or published sources. The interviews proved particularly valuable in identifying conflict within organisations, pertaining to the use of licensing. Conversely however, it was also recognised that individuals being interviewed were likely to give 'their view' of the course of negotiations and agreements. Much of the data was therefore of a subjective nature, and hence had to be treated with a degree of caution in analysis.

A major objective of the interviews was to identify why firms had chosen to incorporate licensing into their new product/market strategies as an alternative to other forms of market realisation. The results of such strategies and the course of negotiation and implementation of licensing agreements were also considered in the light of the inevitable learning processes involved in utilising technology purchase or sale.

Lastly, the success of technology licensing as a strategic tool in the longer term development of the company was considered. In some instances, the product or process involved had only recently been licensed 'in' or 'out' or was still under negotiation, and its long term effect could not be assessed. It was felt important to include such cases, however, because of the closeness of management to current activities and hence to a more accurate recollection of events leading to the use of licensing.

(c) Published Data

Although published statistics on the use of technology licensing appear to be relatively sparse, the UK Government does produce an annual return of receipts and expenditure on 'Technology Royalties'. An investigation of trends in these statistics has been made by Davies and Rosser[1] for a fifteen year period. It is not considered relevant to describe this work in detail here, but reference is made to it as necessary below.

A useful proxy source of statistics on companies and those employed in carrying out licensing functions, is the annual membership register of the Licensing Executives Society (LES).[2] This body comprises the largest professional body for licensing executives worldwide. In the UK there are more than four hundred members of the Society. The 1984 membership register was analysed to define the functional background of licensing executives and to identify those from small firms.

(d) Other Studies on Small Firm Licensing

The fourth source of data drawn upon for the study was results from other empirical investigations into the use of licensing by small firms. The single major study recently undertaken was carried out in Sweden.[3] This study relates to the success of

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1. Davies H and Rosser N. 'International Trade in Technology A Survey' in Lowe J and Crawford N K. op.cit. (c)

2. Licensing Executives Society (UK). Camden Chamber of Commerce London WC7R 4AX

3. Svensson, B. op.cit.

importing technology under licence. No study was made of outward licensing in this work. The investigations concentrated on the process of licensing and its practical use rather than upon the strategic issues involved. However, these case studies do provide a potentially important extra database for comparison with the UK case studies here. Short 'precis' versions of the case studies are appended to the chapter.[1]

3. Data Presentation and Analysis

Data generated and used in this study is presented as follows:

(a) Licensing and the Small Firm. (Leverhulme Study)

The data collected and analysed in this study has been published in journal and book form, as noted above. This will be referred to as appropriate.

(b) Case Studies[2]

The case studies forming appendices to this chapter have been analysed and described in the summary sheets[3] also forming an

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1. Appendix 6.6
2. The case studies are reported using 'blind' identities in all but two cases (previously publicised). Anonymity was guaranteed to case respondents in view of the frequently sensitive or commercially valuable nature of much of the information supplied by them. This included provision of copies of licensing agreements, information on royalty rates, 'up front' fees, and turnover accruing to the agreements. Information on 'gentlemen's agreements' providing for exploitation of particular markets by particular firms was also provided in some instances.
3. Appendix 6. 5

appendix to this chapter. The case companies were described under twenty headings. These are briefly explored below and in more depth under section D4 of this chapter - Testing of hypotheses. The objective of the summary sheets and analyses was to describe each case company within a common framework.

TABLE 6.1

1. COMPANY TYPE
Description

The first heading 'Company Type' comprises a subjective description of each company, and is not analysed further here. The nature of the information on each summary sheet precluded such analysis.

TABLE 6.2

2. OWNERSHIP	No	%
OWNER MANAGED	17	42
PRIVATELY OWNED (not owner managed)	6	16
SUBSIDIARY OR 'GROUP' COMPANY	17	42

A majority of the case companies, 58% were privately owned. These companies were, therefore, not subject to strategic decision making by managers remote from the company. Of the 'Group' companies, a large majority (eleven out of seventeen) were subject to little interference in their decision making structures by 'Group' management. The remainder of the firms were subject to some measure of control at Group level.

TABLE 6.3

3. COMPANY SIZE	Nos	%
0 - 50 Employees	9	22
51 - 100 Employees	4	10
101 - 200 Employees	19	48
200+	8	20

A majority of the case companies (80%) employed less than 200 people. Of the remainder, only two companies employed more than 500 people. These companies were included within the sample because at the time of the licensing agreement they had employed less than 500 people.

TABLE 6.4

4 AGE (years)	Nos	%
Old Established (> 20 years)	27	67
Newly established (< 20 years)	13	33

A majority of the case firms were 'old established', the oldest being founded in 1760.(1) These statistics did not suggest that it was only the young 'growth' companies(2) that utilised technology licensing. Several of the older established firms had diversified away from initial product groups and had developed into completely new 'core' areas two or three times during the life of the company.

TABLE 6.5

5 CLASSIFICATION	Nos	%
Specialised Non Diversifying	15	37
Specialised Diversifying	8	20
Non Specialised - Product/ Technology Oriented	7	18
Non Specialised - Market oriented	10	25

1. Company AA
2. See Table 6.5

The 'classification' heading refers to the suggested framework for classifying companies in Chapter Four of the thesis. Under the 'specialised' (or small market segment) sub-heading, a majority of firms appeared to be developing strategies to further exploit their current markets. Only a minority of this sample appeared to be actively developing diversification strategies. Of the non-specialised (or already diversified) companies, a majority identified marketing skills as their major strength, while a minority of the sample considered that technological skills were their major strength.

TABLE 6.6

6 MANAGEMENT TYPE	Nos	%
Centralised	6	15
Autocractic	16	40
Participatory	18	45

Management type may be an important factor in the propensity of companies to utilise technology licensing. Defining and classifying such 'types' may, however, be more problematical and must, to an extent, be a subjective study. The classification used here divides firms into centralised - chiefly those companies subject to some degree of control from holding company managements; autocratic - where one individual, usually the chief executive was stated to make all major decisions, and participatory - where lower level management and other employees were encouraged to submit ideas to top management. The largest group of case companies in the sample fell into the latter group.

TABLE 6.7

7 COMPETITION LEVELS	Nos	%
Low	8	20
Medium	14	35
High	18	45

The level of competition that each case company was subject to was ascertained through discussions with case respondents. Twenty per cent of companies stated that they were subject to 'low' levels of competition. To an extent this reflects the market position of case companies. In at least two instances, the companies enjoyed a quasi-monopolist position in their main markets. A majority of case companies were, however, subject to either 'medium' or 'high' levels of competition. Many of those companies subject to 'high' levels of competition had encountered severe recessionary related increases in competition levels.

TABLE 6.8

8 GROWTH PROFILE	Nos	%
Expanding	25	63
Static	9	22
Contracting	6	15

Respondents were asked if their company's turnover (after inflation) had expanded, contracted or remained roughly static over a one year period prior to the case study. The results of this analysis suggested that a majority of TL companies were 'progressive' rather than 'parochial'.

TABLE 6.9

9 INDUSTRY	Nos	%
Food, Drink/Tobacco	-	-
Coal & Petroleum products	-	-
Chemicals & Allied industries	6	15
Metal Manufacture	1	2
Mechanical Engineering	11	28
Instrument Engineering	4	10
Electrical Engineering	5	13
Shipbuilding/Marine Engineering	1	2
Vehicles	1	2
Metal Goods	5	13
Textiles	2	5
Leather Goods and Fur	-	-
Clothing & Footwear	-	-
Bricks/Pottery and Glass	-	-
Timber Furniture	1	2
Paper, Printing & Publishing	-	-
Other Manufacturing Industries	3	8

The industries from which case companies were drawn are classified under the standard industrial system. The sample was drawn from a number of industries of which mechanical engineering provided the largest number (28%). The case sample was not drawn up with the intention of identifying companies from particular industries and hence, the analysis above is provided for information purposes only.

TABLE 6.10

10 MARKET TYPE	Nos	%
Growing	13	33
Mature	19	47
Contracting	8	20

The 'market type' of licensing firms was also ascertained from respondents. A majority of the firms (67%) were operating in either mature or contracting industries, suggesting that a major reason for the use of technology purchase or sale was in attempting to overcome the pressures imposed by low market growth.

TABLE 6.11

11 LICENCES	Nos	%
Licences In	17	42
Licences Out	12	30
Licences In and Out	11	28

The number of companies licensing 'in','out' or 'in and out' was a reflection of the method by which case studies had been identified.(1) The number of firms licensing both 'in' and 'out'

1. This was based upon the 'Leverhulme' study noted above.

was the smallest sub-group. This reflected the small number of firms in the total population carrying out both inward and outward licensing.[1] The largest group of licensing companies were those licensing 'in'. This reflected the larger number of such firms in the 'random' sample noted above.

TABLE 6.12

12 NUMBERS OF LICENCES (1)	Nos	%
1	9	22
2 - 5	20	50
5+	9	22
None (currently negotiating)	2	5

A majority of the companies in the survey sample had carried out more than one licensing agreement. To an extent this reflects the preponderance of multiple licensing agreements in outward licensing firms. A small minority of firms (22%), had carried out a relatively large number of agreements. Several of these could be described as utilising licensing as their central strategy.

1. For an analysis of the number of firms in the total small firm population carrying out inward/outward licensing, see Lowe J and Crawford N K, op.cit. (a)

TABLE 6.13

13	LICENSED PRODUCTS

The information under '13' was for descriptive purposes only.

TABLE 6.14

14 'BOSTON' CLASSIFICATIONS (1)	Nos (2)	%
Research and Development	9	19
Stars	19	40
Problems	2	5
Cash Cows	16	35
Dogs	-	-

The 'Boston' Consulting Group classifications(1) provide a framework to analyse products being licensed 'in' or 'out'. The classification suggests that 'star' products requiring large amounts of market development resources and 'cash cow' products,

1. Boston Classifications from Chapter 2

2. Numbers total more than 40 because some companies licensed more than 1 class of product.

generating such resources were overwhelmingly the largest two groups of licensing products. Products and processes at the 'Research and Development' stage also provided a substantial proportion of licensed products. 'Problem' products and 'Dog' products appeared to be rarely licensed, as might be anticipated by the nature of such products.

TABLE 6.15

15 PRIMARY POLICY OBJECTIVE OF CASE MANAGEMENT		
	Nos	%
Survival	9	23
Growth Through Development	20	50
Growth Through Diversification	11	27

The primary policy objective of case companies was ascertained through respondent questioning. Although a minority of case companies identified survival as their current primary policy objective, a majority of firms suggested that growth was their objective. A majority of firms were pursuing a policy of growth through development of current products and markets. Only a minority, 27% of the sample, appeared to be actively seeking diversification opportunities.

TABLE 6.16

16	COMPANY PRODUCT PROFILE (1)	Nos	%
M	Mainly Mature Products	18	45
B	Balanced Product Portfolio	14	35
N	Mainly New Products	8	20

A large number of case companies (45%) had a majority of product lines that could be described as 'mature'. This would indicate a need for the development of new products or new activities. However, it was also clear that a smaller number of licensing companies (20%) had mainly new, young products, suggesting that the latter were also utilising licensing in a proactive manner to retain portfolios with a majority of such products.

TABLE 6.17

17	FUNDAMENTAL NEW PRODUCT/TECHNOLOGY STRATEGY		
		Nos	%
D	In house Development	6	15
H	In house development and technology purchase	22	55
P	Technology Purchase/Sale	12	30

As might be anticipated, a majority of the case companies had utilised technology purchase or sale as one, rather than the major part of their new product/market development strategy. However, an important sub-set of twelve respondents stated that their companies saw technology purchase or sale as the major method of product/market development. Many of these firms were utilising outward licensing to exploit markets they would have otherwise been unable to enter because of resource or other constraints.

TABLE 6.18

18 INITIAL USE OF LICENSING	Nos	%
Reactive	24	60
Proactive	16	40

The initial factors leading to the use of licensing were considered to be an important factor in considering licensing in a strategic sense. Where companies were approached by others or obtained licences from other ad hoc sources, these were considered 'reactive'. 'Proactive' licensing companies were those where a decision had been made, prior to search, that licensing could be a valid method of market realisation. A large majority of the sample (60%) appeared to have utilised licensing in a reactive manner.

Of the 'proactive' licensors, a majority appeared to have utilised it as one part of their new product and market development strategies (see also Table 6.17).

TABLE 6.19

	19 CONSIDERATION OF LICENSING IN PRODUCT/MARKET DEVELOPMENT	Nos	%
A	Always Considered	28	70
I	Considered Infrequently	10	25
N	No Longer Considered	2	5

A majority of case company respondents stated that they 'always considered' licensing in developing new products/markets. This might suggest that previous use of technology licensing had been mainly successful. An important sub-set of companies however, suggested that licensing was either no longer, or infrequently considered, suggesting a degree of dissatisfaction in those cases.

TABLE 6.20

20	PROCESS OF LICENSING
	Descriptive

The summary under number '20' was for the purposes of description only - see summary sheets in appendices.

The brief analysis of case studies above is intended to supply background information for the testing of hypotheses below. Definition of case study companies in terms of the factors used above is considered important in classifying the support that particular cases give to each hypothesis.

(c) Published data

The analysis by Davies and Rosser[1] of UK licensing receipts and payments provides a useful exploration of the background of licensing activities carried out across UK industry. The study suggested that the import of technology through licence agreements (as measured by payments for that technology) had shown an increase

1. Davies, H and Rosser, N. op.cit.

during the late 1960s and early 1970s but had slowed during the late 1970s and early 1980s. However, the authors suggested that the UK manufacturing sector is "very open to the importation of foreign technology". However, it seems likely that a majority of the payments reported were between subsidiaries of multi-national groups, and hence would not be relevant in the context of the sutdy made here. However, analysis of the statistical data does provide a background for the study of smaller firms, in suggesting a relatively strong licensing 'culture' within the United Kingdom.

The second major published data source analysed - membership of the UK Licensing Executives Society, broken down by size of sponsoring company and industry type[1] is made below in Table 6.21 (1).

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1. Data Source - Licensing Executives annual membership register for 1984.

TABLE 6.21

LICENSING EXECUTIVES SOCIETY (LES) MEMBERSHIP (1) BY SIZE/INDUSTRY TYPE/SPONSORING ORGANISATION

INDUSTRY TYPE +	COMPANY SIZE (EMPLOYEES) %			
	LARGE	MEDIUM	SMALL	TOTAL
Manufacturing Numbers (%)	117 (26)	63 (14)	36 (8)	216 (48)
Service * Numbers (%)	84 (19)	37 (8)	110 (25)	231 (52)
All Numbers (%)	201 (45)	100 (22)	146 (33)	447 (100)

+ Small = 0-200 employees, Medium = 200-500, Large = 500+ employees

* 'Service' includes consultants, patent agents, licensing lawyers and unclassified headings.

The membership statistics were also broken down by functional group, as shown below in Table 6.22.

1. Analysis made of LES membership register for 1984

TABLE 6.22

MEMBERSHIP OF THE LICENSING EXECUTIVES SOCIETY (LES) BY FUNCTIONAL GROUP*

FUNCTIONAL GROUP	NUMBERS	PERCENT
Industry	216	48
University and Polytechnics	27	6
Government/ Development Agencies	51	11
Law	38	9
Patent Agents	46	10
Venture Capitalists	6	1
Research and Development Companies	3	1
Consultants	32	7
Retired Members	NIL	-
Unclassified	28	6
TOTAL	447	-

* Analysis made of LES membership register for 1984

The results of the LES analysis show that few small firms' executives are members of the Licensing Society.[1] This would suggest that few small firms carry out licensing activities. This result would be supported by the results of the 'Leverhulme' research noted above, suggesting that less than ten per cent of all small manufacturing firms carry out any licensing activity. However, it is probable that these results should be treated with a degree of circumspection. As noted above, it seems clear that technology licensing is frequently carried out as a 'one-off' situation in smaller firms. This situation should, perhaps, be contrasted with the case in some larger firms where the licensing function is carried out by personnel dedicated solely to that task. This might suggest that such individuals would be more likely to become members of a professional society than small firm executives with multiple functions.

The large numbers (more than fifty per cent) of 'non industrial' society members suggests that TL is both highly activity specific and skill intensive. Patent agents and licensing lawyers, each with approximately ten per cent representation, clearly have an important catalysing and advising role in the use of licensing. However, the number of consultants, representing only seven per cent of the total membership, might suggest that the role of such facilitators is relatively minor in the operation of licensing markets.[2]

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1. That is, excluding 'service companies'.

2. Once again this statistic was supported by the 'Leverhulme' research, where few questionnaire respondents reported the successful use of a new product consultant.

The analyses suggest that a large majority of members of LES are sponsored by large companies in the manufacturing sector or are solicitors, patent agents or other professionals, with small manufacturing companies poorly represented. This suggests that a majority of licensing activity is carried out by large companies, and this is supported by the evidence from Davies and Rosser.(1) However, the figures for smaller firms may be understated for two reasons. First, it has been suggested that small firms carry out licensing on a 'one-off' basis initially, and therefore may not have access to technology networks making them aware of such bodies as LES.(2) Second, it seems probable that larger firm managers may have a greater propensity to become involved in institutions such as the LES.

The second major factor highlighted by the analysis is the large percentage of patent lawyers and consultants who are members of the society. This would suggest the importance of a high skill level within licensing practitioners and might explain the perceived reluctance of many smaller firms to utilise licensing where 'in-house' legal skills were lacking.

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1. Davies H and Rosser N. op.cit.

2. see for example Videm, J. 'Communicating Technology Knowledge to Small and Medium Sized Companies.' International Small Business Journal, Autumn, 1984.

(d) Other Data

Research carried out in Sweden[1] into the import of technology into smaller firms, comprises a study of twenty two separate cases. These studies were carried out over a period between 1981 and 1983. Of these, nine had been deemed to be successful, four had been unsuccessful, three had been launched but had not yet succeeded, while six had not been launched but were still under development at the time the studies were carried out.

The Swedish cases suggest that a majority of inward licensing to small firms can be successful, although in many cases substantial development work may be required before the product can be launched or the process used in local conditions. In a minority of cases, however, the inward licensing product was a failure. In these failures, a major factor appears to have been poor identification of the market that the licensed product or process was intended to supply.[2]

4. TESTING OF HYPOTHESES

Following the presentation of case study and other data, it is now possible to consider the hypotheses generated in 'B' above,in light of the strategic use of licensing by smaller firms. The disparate data sources are useful in considering the hypotheses

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1/2 Svensson, B. op.cit.

from several angles and in the light of both statistical and non-statistical data. One major problem of a case study approach is suggested to be the choice of respondent(s). In a functional field such as TL, where the strategic objectives and decision making processes of the firm may be subsumed within one individual, such a choice may be crucial. Definition of why TL was used, how it was used and the success or failure of the licensing process may be subjective to the respondent. Managers may be reluctant to admit to the failure of any strategy, however impartial the observer, and collection of data may, therefore, be made more difficult. A variety of data sources might appear to be advantageous, therefore, in hypothesis testing. The statistical data provided by the 'Leverhulme' research, carried out under a separate study, is therefore a valuable extra source of information here.

A second major difficulty in a 'case' approach lies in interpreting the replies made to particular questions to respondents and evaluating these in the light of hypotheses generated. A summary of such support is therefore made below.

(a) Summary of Cases/Hypothesis

The form in which the cases were carried out and the subject matter under discussion led to a certain degree of difficulty in defining the strength of support for each hypothesis. The table below (Table 6.23) was therefore drawn up in an endeavour to summarise the support provided by cases for each hypothesis.

Cases were considered to provide strong, medium, low or no support to the hypothesis under consideration. Where a case provided no relevant data for a hypothesis this was also stated. Cases were classified as followed.

<u>HYPOTHESIS 1</u> - Proactive Use of Licensing

Strong Support - Company had developed the use of TL (where this had initially arisen reactively or proactively) and had integrated it into a formal new product/ market development strategy.

Medium Support - Company had recognised the value of TL and had taken some steps to integrate the use of TL into its formalised or less formal development strategy.

Low Support - Company had utilised TL reactively following an external or internal 'trigger' signal, but had taken no positive steps to develop any strategy around the use of TL <u>per se</u>.

No Support - Company utilised TL as a 'one-off' or highly reactive process in response to the offer of a licence from outside the firm.

HYPOTHESIS 2 - Threshold Barriers

Strong Support - Company had purchased or sold technology as a means of overcoming 'in-house' deficiences which it did not have the resources to solve itself.

Medium Support - Company had purchased or sold technology to augment or develop 'in-house' strengths

Low Support - Company had utilised TL as an alternative to 'in-house' development and for other reasons, such as speed of development, but not for resource related deficiences.

No Support - Company had utilised TL solely to augment other forms of development, because of problems such as patent cover on technology it wished to develop. Such licensing was utilised to overcome a particular problem rather than through shortage of resources 'in-house'.

HYPOTHESIS 3 - New Products/Markets

Strong Support - Company had utilised TL proactively to develop into new, diversified product areas or into new markets.

Medium Support - Company had utilised TL to assist it to diversify into new areas, but this had not been its main method of development.

Low Support - TL had been used by the company to develop new products/markets but these had been close to existing skills or areas of operation.

No Support - TL had only been used by the company to extend its product line or to obtain replacement products for existing lines.

<u>HYPOTHESIS 4</u> - Cultural/Social Differences

Strong Support - Company had endeavoured to license to/from a company in another culture and had failed successfully to do so. Alternatively, no agreement had been attempted after consideration of the possibility of TL to/from another culture.

Medium Support - Company had experienced difficulties in TL to/from a company in another culture, but had overcome them after substantial problems.

TABLE 6.23

CASE STUDY SUPPORT FOR HYPOTHESES

CASE STUDY	HYPOTHESIS 1	2	3	4
A	+++	++	++	N
B	++	+++	++	N
C	+++	+++	+++	-
D	+	+	-	+++
E	-	+++	+++	-
F	+	+++	+	+++
H	+	+	+	+++
K	-	+	+	+++
L	++	-	-	+++
M	+++	+++	++	N.
N	+++	-	+++	-
O	+++	++	+++	-
P	+	+++	++	-
R	++	-	-	+++
S	+	+++	+	+++
T	+	+++	+	-
U	++	+++	+	-
V	+	+	-	+++
W	-	+	-	++
X	+++	+++	+++	-
AA	++	++	+++	+
BA	++	++	+	-
CA	+	+++	++	++
DA	+++	+++	-	+
EA	+	++	+	N
FA	++	++	++	+
GA	+++	+++	+	-
HA	+	++	++	++
JA	++	+++	+++	+
KA	+++	++	+	+
LA	+	+++	+++	-
MA	+++	+++	+++	N
NA	+	+	+	N
PA	-	-	+++	N
QA	+++	+++	++	-
RA	-	-	-	N
SA	+	+++	++	-
TA	++	+++	++	-
UA	-	++	+	N
VA	++	+++	+++	++

TALE 6.24

SUMMARY ANALYSIS OF CASE STUDY DATA

HYPOTHESIS		1	2	3	4 (1)
Strong Support	Nos	11	20	11	8
	%	27	50	27	26
Medium Support	Nos	10	9	10	4
	%	25	22	25	13
Low Support	Nos	13	6	12	5
	%	33	15	30	16
No Support	Nos	6	5	7	14
	%	15	13	18	46
Not Relevant	Nos	-	-	-	9
	%	-	-	-	22

Support (Points) (2)	66	84	65	35
TOTAL POINTS	120	120	120	93

1. Nine cases were not relevant to hypothesis '4' and hence have been excluded from the analysis.

2. From Table 6.23 (i.e. +)

Low Support - Company had licensed to/from a company in another culture but considered that any difficulties encountered were easily overcome.

No Support - Company had experienced no difficulty in licensing to/from a company in another culture.

The analysis in Table 6.23 suggested the following support for each hypothesis. (Table 6.24)

The summary analysis of each case study data suggested strong support for Hypothesis 2, since more than fifty per cent of case companies appeared to have utilised TL to break through threshold barriers. However, the other hypotheses seemed less well supported. The analysis above is now considered in conjunction with other data utilised as part of this study in a detailed discussion of the support for each hypothesis.

(b) HYPOTHESIS 1

Technology Licensing is used Proactively by Many Small Firms in thier New Product and Market Development Strategies.

The first hypothesis was suggested by a consideration that TL could be used proactively by small firms as part of their development of strategies to develop new products and enter new markets. Clearly, TL could be used in this manner. However, it is also probable that a majority of smaller frims carry out no formal strategic processes [1] rather developing strategy formulation as a more informal process. The subject under consideration here, therefore, usually relates to such informally developed strategies.

Other research[2] suggests that only a small proportion of small companies had utilised or had considered utilisation[3] of TL. However, case study respondents suggested that following initial, frequently 'reactive' consideration of TL, a majority had utilised it and now always considered it in the development of their new product/market strategies.[4] This might suggest an information barrier to the use of TL or the operation of a long term learning process before it could be used effectively.

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1. See for example Hankinson, A. op.cit.

2. Notably the 'Leverhulme' research. See for example Lowe J and Crawford N K. op.cit. (A)

3. Lowe J and Crawford N K. op.cit. (A).
Less than twenty per cent of small firms had considered utilising TL and less than ten per cent had done so.

4. See Table 6.23 and Tables 6.17,6.18, 6.19 above.

Within the minority of the total population of small firms using TL, it is relevant therefore to consider which of the case studies here supported the first hypothesis put forward above. Of the forty cases considered, only eleven could be said to 'strongly support the hypothesis'.(1) Of these, companies N, X, MA and QA are considered to be particularly relevant.

Company N had become involved in technology licensing in reaction to an outside threat. However, although the initial impetus to licensing was reactive, the company had developed a highly proactive strategy around the use of outward licensing, recognising it as an alternative method to fulfil company objectives which had been undermined by problems with developing markets through 'in-house' manufacture and export. The company, based in a relatively traditional field had utilised licensing extremely satisfactorily.

Company X also appeared to have developed a highly successful strategy for the utilisation of outward licensing to exploit technological leadership. Management recognised that its resources were insufficient to exploit foreign markets through joint ventures, while the use of direct export was also inappropriate because of the nature of the technology involved. To this extent, therefore, the company was also reacting to an outside factor. The only rational method of market realisation was recognised to be through outward licensing. However, the company

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1. See Table 6.23 and Tables 6.17, 6.18, 6.19 above

had developed its strategy in a highly proactive manner to exploit its technology successfully.

Company MA had used inward licensing as part of a planned diversification strategy away from its current service based skills. In this it was one of a small minority of cases utilising inward TL in this manner. The company had carried out an evaluation of its strengths and weaknesses and decided to enter manufacturing following this evaluation. However, even in this case, the company arrived at the initial decision to license, as the result of successful franchise operations which it had undertaken to diversify from service activities. Once again the initial decision to license had been triggered from outside the company, although the company then went on to build upon its first licence and to develop a stratety proactively for the further use of inward licensing.

Company QA developed its strategy for the use of 'outward' licensing as the direct result of a strategic decision to develop its business through the sale of technology rather than the sale of goods. In this instance, either strategy might have been anticipated to be successful, since the company had technological leadership in its field. It chose the licensing route because it believed that this strategy would allow it to develop faster and further than would the sale of goods.

The few cases explored briefly above did not appear to be typical of the majority of small firms interviewed in the course of this investigation, but comprised particular examples of a minority of them. Two factors became apparent with regard to Hypothesis 1. First, more firms appeared to develop strategies for outward TL in response to their development of high demand innovative products, than for inward TL in response to a requirement for new products. This might suggest that it was the more fundamentally 'go ahead' or 'outward looking' companies that had considered the use of TL prior to its implementation. However, even in those cases quoted above, the initial impetus for the use of TL had usually arisen in response to a 'break through' technological development, and recognition by management of its potential, rather than as part of any strategic planning process. Secondly, particularly in the corresponding process of inward TL, those firms which had developed its use as part of their strategic planning processes had generally been forced to develop strategic plans initially in response to an external threat, rather than as part of a longer term and planned process.

TL appeared therefore to be used most frequently as a reactive process, particularly in the case of inward licensing. However, a small sub-set of small companies clearly had utilised inward and outward TL to develop new products and markets. On the basis of the numbers involved however, the first hypothesis cannot be said to have been strongly substantiated.

(c) HYPOTHESIS 2

Licensing Assists Small Firms in Overcoming Threshold Barriers

The second hypothesis was suggested by a consideration that TL could be utilised as a resource conservation process. In principle, it might appear that more research and development activity per unit of expenditure could be achieved through the purchase of already developed technology than through 'in-house' development. This might be particularly crucial in smaller firms. Conversely, the use of outward TL might also allow smaller firms to enter larger numbers of new markets. It was suggested, therefore, that TL might allow both product threshold barriers in home markets and export market barriers to be overcome. This proposes that firms utilising licensing would not have developed those products or entered those markets if TL had not been used.

Other research(1) suggested that very small firms carried out less TL than larger small firms (100 employees and more). This would suggest that the former firms may not have sufficient 'in-house' resources to benefit from the use of TL effectively. Licensing firms appeared to be more research intensive(2) than non-licensing firms and also had faster growth rates. They also appeared to be more diversified.(3) This might suggest that typical licensing firms were utilising the technique to develop and to diversify. The research results from Chapter Three of

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1. See Lowe J and Crawford N K. 'Leverhulme' research, op.cit.(A)
2. Lowe J and Crawford N K. op.cit (A) Table 4
3. Lowe J and Crawford N K. op.cit (A) Table 5

this thesis also suggested that larger 'small' firms carried out diversification into new product/market areas more than either very small firms or large firms. Clearly research intensive firms of this type are likely to reach threshold barriers relatively quickly if growth rates are continued. Since such firms appeared more diversified,this suggests that the only way growth had been continued was by development into other, small, market niches. It is a proposal of the hypothesis stated above that once this form of lateral development had been continued into several new product areas, the firm might begin to lose its core strengths and become overdiversified. This could lead to renewed pressure to utilise licensing to strengthen core skills and grow into larger markets where competition levels might be likely to be higher.

A strategy of enhancing flexibility and developing into a number of new markets might therefore lead, as size increased, to the necessity to overcome threshold barriers if growth was to continue. However, breaking through such thresholds might incur high risk levels which might also be reduced through licensing.(1) Thus licensing could enhance the chances of breaking through such threshold barriers both by reducing costs and reducing risk.

The case study analysis suggested that many of the sample companies were subject to a high degree of competition, and were also

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1. See for example, Lowe J and Crawford N K. op.cit (D)

seeking high growth levels.[1][2] This might suggest that such firms were utilising inward TL to provide suitable products for such growth. Of the products licensed, more than 40% were stated to be of the 'star' variety under the Boston Consulting Group Classification.[3] Development of such products on a consistently successful basis might be problematical for firms to achieve 'in-house'. In such instances TL might be a means of obtaining successful products to break through such threshold barriers.

The case studies tend to give support to the hypothesis proposed above. Notable cases included E,F,M,JA,X,SA and TA.

Company E as a marketing company without products of its own wished to move into production of its own product line through the initial use of sub-contract manufacture and 'in-house' assembly. However, there was very little production skill 'in-house', although the company did possess a small research and development department. This department however, did not possess the necessary resources to develop a new product from design to implementation. The company was therefore unable to overcome this R & D threshold through the use of its own resources. The use of licensing however enabled it to move into a large and expanding market where its marketing expertise gave it a competitive advantage. Without costly production facilities

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1/2 Tables 6.7 and 6.8

3 Table 6.14

the company was able to obtain its products through sub-contracting at a highly competitive price and was able to undercut rival products which were being imported into its market.

Company F utilised TL because it had inadequate resources to develop a product for diversification into a new market it had identified as having great potential. In this instance the research threshold could not be overcome at an acceptable level of risk and hence licensing was used to enter the new market. Although the product was not a great success it did allow the company to develop a new expertise, and the technology (as distinct from the product involved) that was transferred to the company was utilised in developing other products within that market.

Company M had utilised licensing as a means of continuing its strategy of uninterrupted growth. The Managing Director of this company admitted that without licensing the speed of development could not have been maintained, since the company had a relatively small technology base. Licensing was being used to bring in technological skills which could then be used in further product development. This highly proactive use of licensing to overcome research constraints was perhaps, the best case example of a company utilising licensing as part of its strategy to grow and develop into new markets.

Company JA had reached a technological plateau. While its 'in-house' research and development skill was high, a result of its contract research expertise, it had no manufacturing base. With its small size it was unable initially to obtain sufficient resources to enter its target market. Development costs for products in that market were extremely high. In response to these pressures, company JA developed a strategy to enter home markets on the basis of a product licensed 'in', and to develop that product further so that it could be licensed 'out' on completion of development. This strategy was successful and allowed the firm both to overcome its research threshold, but also to break into new markets overseas, thus also breaching a marketing threshold.

Company X adopted technology licensing as a means of increasing turnover without the necessity to grow in size. Company management wished to stay at roughly current size levels since they believed that further growth in numbers would make the firm more difficult to manage. Once again the licensing process was successful and Company X was able to license the process in question both 'in' and (after improvements) 'out'.

Company SA had small financial resources, strong 'in-house' R & D capabilities, and wished to move into new product areas. It recognised however that it did not have the capability to diversify both its production and its marketing structures simultaneously. Management, initially, accepted technology licensing on an agency/franchising and assembly route basis followed by 'in-house' manufacture. This allowed it to move into a new market segment utilising a 'gradualist' approach. It would probably otherwise not have been able to fund initial development of the product in which it is currently virtually a monopoly supplier in its field, even though it recognised the market opportunity. Consequently, inward licensing enabled it over a three year period to overcome the threshold barrier it had encountered.

Company TA had developed a strategy to provide a complete range of metal surface hardening treatments. However, much of the technology currently replacing obsolescent techniques would have required an expenditure which, in view of the size of the firm would probably have been unwise and would also have been unlikely to have been funded by the parent company. By utilising technology licensing, Company TA was able to obtain the technology at much reduced cost, but possibly more importantly, at a greatly reduced risk profile. Although the development is still relatively 'high risk' in view of company resources, failure would not be a <u>catastrophic</u> experience for the company in the opinion of management.

The case studies and other evidence cited do suggest that smaller firms are able to utilise technology licensing as a method of overcoming threshold barriers in some cases. In the Boston Consulting Group[1] Categorisation, many of the case firms

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1. See Chapter 2

had licensed in 'star' products, where the major development cost of converting those 'stars' to 'cash cows' was borne by the licensor. The firms were effectively purchasing the accumulated experience of their licensors, allowing them to compete successfully against, in many cases, much larger companies within new and diversified markets. The Swedish case studies, notably cases number 1, 2, 3, 7 and 21[1] also support the proposal that smaller firms <u>can</u> utilise technology licensing to overcome threshold barriers, and grow beyond the limitations, sometimes self-imposed, of managerial structures developed at an earlier stage of company growth. It is suggested therefore, that Hypothesis 2 is generally supported by the case study and other data.

(d) HYPOTHESIS 3

<u>Licensing Allows Small Firms to Obtain Products and Enter New Markets at Lower Cost and Reduced Risk than Through Other Forms of Development</u>

Hypothesis three was suggested by the evidence, presented in Chapter Two, that small firms appeared to be more diversified in the 100-200 employee size range than in smaller or larger companies. This suggests that many small firms enter new diversified markets as they develop. The hypothesis here

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1. Svensson, B. op.cit.
   See Appendix 6.6

suggests that smaller firms utilise TL in their product and market diversification strategies. If this was the case, it would suggest that some smaller firms are explicitly or implicitly utilising techniques similar to those proposed by the Boston Consulting Group matrix to develop or dispose of products and enter or leave markets.

Consideration of the 'Leverhulme' study statistics[1] suggested that TL companies were more diversified than non-licensing companies. Twice as many licensing companies operated in two or more markets than non-licensing companies. The sample firms did not, however, quote diversification as a major reason for <u>inward</u> licensing (only nine per cent of cases). This would suggest therefore, that most small firms do <u>not</u> utilise licensing in this manner but that a minority of firms do use licensing proactively in this way. This would be supported by the evidence of diversification by smaller firms presented in Chapter 3. Clearly, a small number of 'progressive' firms do both license and diversify more proactively than the majority of the population of firms.

The major use for inward licensing appeared to be in extending product lines. This sometimes led to technology being purchased which later formed the basis for diversification into other product areas however. Inward licensing had, therefore, acted as a <u>bridge</u> in these cases, allowing later development into areas outside current skills.

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1. Lowe J and Crawford N K. op.cit. (A)

The case study analysis also suggested that case companies were utilising technology licensing to obtain new products for new markets; 43% of companies were of the 'non-specialised', i.e. diversified type under the classification made in Chapter 4[1] and twenty seven per cent quoted growth through diversification as a primary policy objective. However, since more than fifty per cent of the sample quoted growth through development in current product areas as their primary policy objective, it seems clear that most case companies had utilised inward licensing mainly to complement existing skills. Companies E, M, CA and VA were good examples of this.

Company E had licensed a new product 'in' which built upon its existing marketing skills, but encompassed diversification of its technological skills into a new area. Company M had diversified into new areas of the market close to its current strengths. Company CA had utilised inward licensing to extend its product lines into new areas of application. However, Company VA provided possibly the base case study example of a company which had utilised inward licensing to endeavour to develop into entirely new and diversified areas. In this instance TL was seen as the only realistic method for the company to develop into higher technology areas in which it currently had few skills, while building on existing strengths. Alternative strategies that had been considered included the use of franchising, to market products first before manufacturing them 'in-house', but this strategy had mainly been rejected

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1. Table 6.5 above

in favour of the licensing option. All the four case studies quoted supported the hypothesis that smaller firms can utilise licensing to obtain products and enter markets at relatively lower risk than would be the case utilising 'in-house' development. However, the quoted cases were typical of only a minority of the case studies with regard to inward licensing.

In contrast to the somewhat unclear picture of inward licensing and product diversification, the situation of <u>outward</u> licensing and market diversification was much more clear cut. Both the Leverhulme study and the cases suggested that a large number of firms proactively utilise outward licensing to diversify into new markets. Company N, for example, utilised outward licensing to provide high cash flows for developing product lines, allowing development of the company <u>out</u> of manufacturing and into the service sector. Company O also utilised outward licensing to obtain maximum returns upon a successful product line. Company X utilised outward licensing to obtain a return on costly research and development programmes, allowing it to retain market leadership in its own market. In contrast, Company NA had utilised outward licensing to overcome price constraints restricting it from certain export markets. Through the use of licensing it had also been able to compete with overseas competitors in third markets and hence to build upon its initial technological success by further enhancement of its products. Without the use of licensing the firm would probably have been unable to enter those markets, or raise the finance to develop its product lines.

Under the Boston Consulting Group analysis of cash flows between products, several of the case companies could be classified as exploiting 'cash cow' products as the case analysis suggests. Thirty five per cent of cases [1] had licensed products that could be described in this manner. Clearly, income accruing from such exploitation could be utilised to fund other activities. That some firms do, at least implicitly, adopt this approach, is also supported by evidence of the returns accruing to a sample of companies studied in conjunction with the Leverhulme analysis noted above, which suggested that returns in the hundreds of per cent could be achieved. [2]

In conclusion, it did not appear that TL is generally used by small firms to diversify into new product areas, although a small minority of case companies had utilised TL in this way. It is postulated that the diversification observed in the small firm sector and explored in Chapter 3, arises more frequently in an incremental manner out of areas in which that firm is already operating. A large majority of case companies considered that their primary policy objective was either 'survival' or 'growth through development of current activities', rather than diversification into new ones. [3] Those diversifying companies appeared mainly to be those which had outgrown current small market niches [4]. In addition, several of the case companies had

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1. Table 6.14 above

2. Lowe J and Crawford N K. '<u>Outward Licensing as a Marketing Strategy -An Analysis of Returns</u>'. Paper presented to Conference on 'Buying and Selling Technology', September 1983

3. See Table 6.15 above

4. See Table 6.5 above

extended product lines throughTL which could be classified as diversification. Licensing appeared to act in some instances as a 'bridge' or catalyst to diversification processes. In outward licensing however, smaller firms had clearly made extensive diversification into new markets through the use of TL. It is considered therefore, that hypothesis three is supported in the case of diversification into new markets by outward licensing, but is less strongly supported in the case of diversification into new product areas through inward licensing. Inward TL appeared to encompass more incremental development, i.e. a low risk approach however.

(e) HYPOTHESIS 4

Cultural and Societal Differences Preclude Licensing Agreements Between Different Cultures by Small Firms

The last hypothesis was suggested by a consideration of the potentially high opportunity costs of carrying out TL by small firms. While larger firms may have specialist personnel to undertake the TL function,in smaller firms executives unversed in the use of TL may be involved. Licensing to or from culturally different markets may impose greater difficulties on such executives than licensing to or from culturally similar markets.

The results of the Leverhulme study[1] gave an important

1. Lowe J and Crawford N K. op.cit. (A)

insight into the source and destination of licensed products/ technology in small firms. Companies were asked to denote the nationality of their licensing partners. The results of this survey comprise Table 6.25[1].

TABLE 6.25

SOURCE /DESTINATION OF LICENSED PRODUCTS

Country	Inward Licensing		Outward Licensing	
	No of Licences	%	No of Licences	%
UK	20	28	5	9
USA and Canada	28	40	9	16
Europe	18	25	18	32
Japan	1	1	6	11
Other English speaking	2	3	17	30
Other non-English speaking	3	4	2	3
TOTAL LICENSES	72	-	57	-

The data in the table suggests that licensing 'in' by small firms is overwhelmingly from the UK, the USA, or from other English speaking countries. (71%). While this might suggest

1. Lowe J and Crawford N K. op.cit. (A)
The full analysis was not included in the paper noted above, but comprises part of the report made to the Leverhulme Trust.

that the best technological opportunities exist in these countries, it is interesting to note that inward licensing from Japan only occurred in 1% of cases. For outward licensing however, English speaking licensees only accounted for 55% of cases, although a much larger proportion of these occurred in the non-American English speaking countries (30%). This might suggest that outward licensing to the USA is subject to substantially greater barriers than inward licensing. However, in the light of the cultural similarities between the two countries, it can also be postulated that these are predominantly economic and technological barriers. Outward licensing to non-English speaking countries accounted for 46% of all licensing activity. This suggests that outward licensing firms may be more prepared, or able, to overcome cultural barriers in their search for new markets.

The case study data also supported the view of a major difference between inward and outward licensing. Of those companies which had successfully utilised outward TL to markets in non-English speaking countries, companies O, P, BA and QA appeared to be particularly relevant. However, the licensing activity carried out by these companies should probably be considered in light of the central role that outward licensing was playing in the marketing strategies of these cases. All the four case companies had developed 'in depth' skills in the use of outward licensing and saw it as their major activity. It is suggested therefore, that these cases may be atypical of the majority of smaller licensing firms.

In those cases of companies with no, or little prior experience of outward licensing, it was apparent that breaking into culturally different markets using licensing was frequently difficult. In the case of companies R and V, 'one-off' outward licensing negotiations had failed to provide a successful outcome. In the case of company R, although the product involved appeared to be highly suitable for the market into which it was aimed, problems in negotiating with African companies had precluded success. In the case of company V, negotiations were commenced with a number of companies in countries with very different cultures without success. Part of this failure may relate to internal 'firm specific' factors militating against the success of any 'external' activities of this kind. However, it was also clear that methods of doing business, the nature of the technology involved and failures of communication between the different parties had also obstructed success.

The case studies of inward licensing suggested that obtaining technology from firms with similar cultures was substantially more simple than from dissimilar cultures. Thus, in the case of company K, no successful agreement resulted from preliminary negotiations with a German company. Even in the case of inward licensing from a relatively similar culture, problems could arise as a result of cultural differences however. Thus in the case of company F which was licensing 'in' from an American company, differences in UK and American standards led to major problems in sourcing components for the licensed product. However, it was also clear that where smaller firms had approached licensing with companies in different cultures, success could be achieved with a professional approach. Thus companies LA, SA and TA had licensed products and technology 'in' from non-English speaking countries. In each case, the impetus to and necessity for, an agreement, had led to success.

In conclusion, the evidence to support Hypothesis four is somewhat confusing. While the 'Leverhulme' evidence suggested that small firm TL to or from different cultures was restricted, the case study data in total suggested that numbers of small firms had successfully licensed to/from different cultural areas. However, it was clear that in many of these cases, of which a larger number were <u>outward</u> than <u>inward</u> TL, it was the professional and long term approach that had succeeded in overcoming sometimes substantial barriers to TL. In the light of this it is concluded that hypothesis four is broadly correct. Important barriers do exist to the easy use of TL to/from different cultures. However, it is also clear that where small firms are prepared to attempt to overcome these barriers, success can be achieved.

E. CONCLUSION/DISCUSSION

The major objective of this chapter was to draw together the results from previous chapters and to integrate those results with the case study and statistical data presented above. The role that technology licensing might play in the new product and market strategies of smaller companies was explored. Models were constructed in an endeavour to define the external and internal environmental effects that might impinge upon smaller firms in this regard.

It is clear from the empirical studies that technology licensing does play an important role in the technology strategies of <u>some</u> smaller firms. However, the use of such licensing processes must necessarily be considered in the context of the major objectives of smaller firms and the pressures affecting them. A large majority of the case studies suggested that technology licensing was utilised by smaller firms in a highly <u>reactive</u> manner, as the response to a product crisis within the firm, or for other 'survival' reasons. In the case of inward licensing, this strategy frequently appeared to have met with success. Most of those smaller firms which had utilised outward licensing had also done so reactively. Frequently this had occurred because of the success of the firm in developing particular products for its own home market. Success in this home market had then led to approach by other, foreign, manufacturers wishing to utilise licensing to obtain the product for exploitation within their own market.

Once again, many of the case study companies appeared to have utilised outward licensing successfully, following such initial approaches.

Although the 'trigger' to the use of licensing had frequently operated in a reactive manner, many of the case companies had then apparently developed licensing strategies in a highly proactive manner, as the potential for the use of the technique became apparent to them. This might suggest that many smaller firms may be able to accept new ideas relatively quickly and exploit them successfully.

Of the four hypotheses proposed within this chapter, it is suggested that the first, suggesting the proactive use of licensing by smaller firms is clearly unproved. The second hypothesis, suggesting that threshold barriers can be overcome by the use of licensing is generally supported, although as suggested above, few case firms appeared to have utilised licensing explicitly for this purpose. The third hypothesis suggesting reduced risk and cost in entering markets through licensing, also appeared to be broadly supported. Lastly, the fourth hypothesis, exploring the effect of national cultural barriers to the successful use of licensing also appeared to be supported. The small number of agreements between small UK licensors and licensees and counterparts in non-English speaking countries also suggested this.

In conclusion, Chapter Six has endeavoured to explore the strategic use of licensing in smaller firms in depth. It is an objective of the final chapter briefly to integrate the findings reported above into the context of the other subjects of this thesis, namely diversification and the development of business policy in smaller firms.

APPENDICES TO CHAPTER 6

APPENDIX 6.1

INWARD LICENSING CASES

COMPANY A

Respondent: Managing Director

Company A[1] is a small (50 employees) independent company producing equipment for public utilities, and testing equipment for major manufacturers of electronic components. At the time of the case study the company had had a recent record of relatively fast growth as the demand for integrated circuit testing equipment had grown. However, the company had been constrained by problems of recruiting suitably qualified staff, since the skill levels utilised in the design and construction of integrated circuit testing equipment require graduate or postgraduate level staff. This problem had been overcome to an extent by sponsoring some students on electrical engineering courses at several UK Universities, but this had been a costly programme and had not provided sufficient trained manpower for the company's requirements.

The company which currently employs fifty people was founded in 1966 when the present Managing Director left one of the major UK electrical manufacturing companies where he had been a senior research manager. The development work he had been carrying out had led him to realise that there was a market opportunity in the field of 'Weston' Standard Cells. This was a relatively mature product which could not be described as 'high technology' but

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(1) Company A was identified through the 'Leverhulme' research described in Chapter 6.

there was a continuing steady demand for the product which was not being met adequately by current suppliers. Following the formation of the company and the obtaining of several major contracts for supply of the 'Weston' Cells, the company diversified into other low technology, small market niches in the field of electrical components. From this base, the company has steadily expanded both in size and in its technological capabilities, by moving into sub-contract work for Original Equipment Manufacturers, technological leaders in the electronics field. Several of the Utilities are now major customers for its range of testing and allied equipment and the company is recognised both for its technological expertise and the high quality of its products.

Company A has utilised inward licensing in two cases. The first case arose in 1974 when the Post Office suggested to the company that it might consider developing a new method for locating underground cables and pipes, since current methods for achieving this were relatively unreliable. In this case, the Post Office supplied a great deal of technology to the company from its own laboratories, on the basis of a sub-contract agreement whereby the rights to the new product belonged to the Post Office. The product was a success and following supply of a large number of locators to the Post Office, the company obtained an agreement whereby the product was 'licensed' to it for a ten year period. This gave the company the rights both to develop the product further and to market it inside and outside the UK. This was a very advantageous agreement for Company A since a 'captive' market was supplied and competitors were excluded from that market by Utility purchasing policies. The product proved to be extremely profitable.

Three years after the first licence, the company sought proactively for a similar agreement with another Utility, the United Kingdom Atomic Energy Authority, for a portable 'dosemeter' to measure radiation levels within nuclear installations. Once again technology was transferred to the company from the Utility on the basis of a sub-contract whereby the company supplied the Utility with the product, in return for the rights to use it for other markets and to supply it to other customers in the UK (although this was a very small market in world terms). The second product was also a success for Company A in strengthening its technological base and allowing for development of the company into diversified fields outside its own current strengths. The licence has been an important plank in the success of Company A and has led to a continuing search for similar inward licensing agreements with UK Utilities and with large companies seeking long term suppliers for particular sub-assemblies incorporating technology in which Company A has strengths.

At an early stage in its development, the company management decided upon a strategy of utilising easily available technology to attack small market segments in which it could build up an expertise. The licensing agreements allowed it to continue to develop small market segments utilising the technology of others, to become the dominant supplier, indeed the monopoly supplier of particular types of equipment. Company A has therefore utilised licensing to overcome some of the dangers of competition by co-operating with much larger concerns which, by their size and monopoly strengths had previously reduced the possibilities of effective competition. This has been most important in the development strategy of Company A and is one which is being continued within current new product developments.

COMPANY B

Respondent: Managing Director

Company B[1] is a subsidiary company of a medium sized engineering group employing about 200 people. The company produces sub-assemblies for the engineering industry that are to be incorporated into products by Original Equipment Manufacturers. At the time of this case study the company employed approximately one hundred people and had been increasing its volume sales by an annual average of twenty per cent during the previous four years. The use of licensing has been an important factor in this growth and has been utilised over an extended period of time by the company.

Company B has two experiences of licensing: the first dates back to 1964, and was in the area of automatic control valves. At the time the parent company produced sophisticated control systems and was seeking to diversify into new areas of operation. It used Company B to identify and develop into new market segments. Company B employed marketing consultants to look at possible areas of diversification and identify potential licensors in the area of sophisticated control systems. In particular it specified that any technology to be licensed 'in' should have synergy with the technological side of what the company was doing. The consultants recommended that of the options of licensing or purchase of another

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(1) Company B was identified through the 'Leverhulme' research described in Chapter 6.

subsidiary company, licensing was the most cost effective, and likely to prove the most technologically effective method, since the continuing resources of the licensor could be utilised in the further development of new products. Following the consultants' advice the company took on a fluid control system from the USA which had many similarities from a technical point of view with existing company products. However, the product involved very different markets in which Company B had little experience. In the short run the product was a success and indeed in the longer term the product could be deemed to have been successful. However, a major problem that arose was that Company B came to rely heavily on its licensor's R & D expertise and when the licensor decided to end further development in this area, Company B found itself with a technologically obsolescent product which it did not have the resources to develop further itself. This problem did not occur until 15 years after the original licence was signed, but it did mean that after 15 years with developmental work on the product being carried out by the licensor, Company B was left with a product that was not technically advanced.

At this point the company decided it had to have new products, and accepted several agency agreements, to act as distributors for other companies' products. The result was that the agencies became the most important aspect of the company's business, leading to an even greater diminution of its R & D capability and manufacturing base. However, the agency agreements were very profitable, and the company continued to achieve a satisfactory return for the parent group.

Company B did not stop manufacturing completely, however. In the late 1970s a new Managing Director identified an opportunity in the electronics market caused by a requirement for load-cells for electronic cash registers. At a trade fair he met an Israeli producer who had a product available for license which fitted the specific requirement he had in mind. Company B took on the licence for this load-cell which was extremely successful. The only problems have been in communication between licensor and licensee. Current production levels are approximately 2000 units per month and a new factory has had to be set up to deal with the extra production. The Managing Director suggested that the only alternative to licensing in, in this case, would have been 'in-house' development which could have cost the company half a million pounds and would have required a long term research and development effort. This would probably have been unrealistic in the light of the company's lack of R & D facilities consequent upon its previous decision to end manufacturing and related activities.

Both the first and the second case of licensing were successful. However, the two cases were dealt with in very different ways. In order to prevent licensing causing the company to become solely reliant on other people's technology, as happened on the previous occasion, the company recruited its own scientists and engineers to develop the product further, such that it has now made many substantial changes and improvements to the product, at the same time building up 'in-depth' R & D experience and facilities. The improved product is being sold in Israel through the original licensor's distribution outlets.

Following its own two successful cases of licensing, the company is convinced that licensing represents a good strategy to pursue and consequently it is currently negotiating with a European company for a water-flow meter under licence. Management suggests that the new product will fit well with existing marketing skills as well as conforming to skills on the production side.

Company B has had a long history of the use of licensing and hence it appears to be an accepted strategy within the company. In general, Company B has reacted to its technological strengths and changes in the market in an interesting way. The first product it licensed augmented existing production and market skills, but recognition by the company that it was losing its competitive advantage in this area led it to take on agencies and become a marketing company alone. This strategy was successful and the firm moved out of manufacturing, but returned to it, through the use of a licensing agreement, again, highly successfully.

The case suggests that Company B acted in a highly flexible manner. However, it was a recognition by the company of where its comparative advantage lay, that is probably the most important factor in this case. Company survival was, probably rightly, seen as the most important factor, with the way that survival was achieved as a secondary consideration. The company did not consider itself as a "manufacturing concern" or as "a marketing operation", just as an organisation, that needed to survive. The use of licensing was fortuitious in allowing it to move in and out of manufacturing in a highly flexible manner.

COMPANY C

Respondents: Managing Director and Sales Director

Company C's[1] origins lie in the need, during the Second World War to manufacture wood panels used in the aircraft industry. The company was set up by a large company to take account of this requirement and developed its expertise under contracts from the UK defence department. Following the war the company continued to manufacture plywood and other wood composite panels. However, this activity was never very profitable and the company survived by contracting out its expertise in R & D in wood products.

In the late 1950s, the present Managing Director, then a management trainee in the parent company, met at a trade fair the representative of a German company which wished to license its innovative and patented wood particle moulding technology 'out'. The German firm had recognised that, although its process produced wood particle boarding at a cheaper price than the competition, it would still be unable to compete against local manufacturers in other markets, even those using less effective, outmoded technologies, because of the high weight/value ratios of its products. Transport costs made the exploitation of foreign markets very difficult for it and therefore it turned to licensing agreements for its technology. Following agreement between the UK company and the German licensor, Company C

(1) Company C was identified through the 'Leverhulme' research described in Chapter 6.

has developed and expanded, becoming market leader in its own market segment in the UK. It currently employs nearly 200 people and has a turnover of more than four million pounds per annum. The company is currently seeking to grow at a faster rate by taking on more licensing agreements and developing its own new products 'in-house'.

From one licence (to the UK company) the German firm has expanded its licensing activities so that several dozen countries are now covered by licence agreements. The licensees have formed an association with the licensor for the free flow of ideas between them. Any new idea thus gets quickly passed around the group (at no gain to the instigator). This is clearly advantageous to the licensees who are not competitors with other licensees because of the nature of the products they are producing, as suggested above.

Company C is very skill intensive. The Managing Director thinks it unlikely that a competitor could break into the market however much money he spent on trying, because of this skill intensity. The licensor/licensee relationship is such that the resources of all licensees would be available to any licensee company fighting against an endeavour to break into its market.

Company C now has three licences from its German licensor (with more being negotiated). Until recently it had not considered the use of any other sources of technology (i.e. other licensors), but now is actively seeking ideas from other sources such as Contract Research and Development companies and from other manufacturing concerns.

Although the company had made extensive use of licensing, the Managing Director had not utilized the large number of licensing journals that were available, nor had he made use of licensing consultants. He considered that consultants might be useful in finding new products in some cases, however.

One problem that Company C had recognised in its use of licensing was that the licensor may make more money than its licensee out of an innovation. It was suggested that in its own case, a payment of four per cent of turnover (the royalty rate) might be 50% of profit, because of the highly competitive environment in which it was operating, and low margins. In Company C's case, the licensor has used these profits to plough back into R & D within the business and had clearly used its licence income to retain its technological lead, which resulted in further licences accruing to it.

The Managing Director made the point that there was a difficulty in finding suitably qualified staff to recognise new licence opportunities. Although technical staff might visit Germany to see the main licensor they might not recognise a potentially transferable technology. He suggested that the sort of person required needed to have some technical background but also a commercial "eye" and in his experience the two were not often combined. This is possibly a relevant point in the context of the current search by the company for new product opportunities through licensing.

The Managing Director considered that Company C was an innovative growth oriented company and looked forward to expanding his company both through diversification and by expanding the company's share of its own market. The company has had a steady record of growth and profitability under the umbrella of the parent group and this was expected to continue into the future.

Company C was based upon a licensing agreement. In that sense its whole strategy has depended upon the use of licensing. However, this case is probably particularly important in demonstrating how technological dependence upon 'bought in' technology can in some ways act to the long term competitive disadvantage of the company. Company C appears to be locked into a network of licensing agreements with its main licensor. Licence payments account for a substantial proportion of the profits of the company, which therefore has less resources to devote to its own research and development programme. It has therefore, been forced to seek new technology through further licence agreements (with other licensors) rather than developing its own technology.

In general, Company C appeared to be developing its new product strategy solely through the use of inward licensing. It does not export its products and would probably find it difficult to do so, both because of their size/weight and because of restrictions on development into other markets by its licence agreements.

COMPANY D

Respondent: Managing Director

Company D[1] was established in the early 1960s as a small independent company supplying glass reinforced plastic (GRP) products to (usually) trade customers. About twelve years after being set up and following a sustained period of growth, the company was taken over by a medium sized, diversified company, comprising several semi-autonomous companies. The company was allowed to keep a great deal of independence within the group but benefited from access to the Research and Development, managerial and financial facilities within the group.

Following the takeover the company gradually began to specialise in development and manufacture of large complex shaped products in GRP and in long-run production items where economies of scale could be made. This led to a narrowing of the number of markets in which Company D was operating and a reduction in the number of product lines. The company's main market now, in which it is one of the market leaders, is the supply of cladding panels and other structural and non-structural products to the building trade.

The company has developed its production and development expertise such that customers can specify a design and the company's staff

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(1) Company D was identified through the 'Leverhulme' research described in Chapter 6.

can then define whether this will be possible to make economically. At present, the company has a production facility in excess of 8000 square metres and employs a staff of just less than one hundred. Of these, about 20% are employed on R & D and customer design/ support services. It is the company's philosophy to be in the forefront of GRP technology and to this end it is always actively seeking new products and/or techniques to make those products.

The company has licensed 'in' three products, in one case because they were approached by another company, and in the two other cases because they approached others who had technology to offer. The company actively advertises for potential licensors as part of its new product search process. This is mainly done through various technical journals at approximately six monthly intervals and according to the respondent usually brings in about 25 responses, most of which describe potentially valuable products, but very few of which lead to the licensing 'in' of a particular product. The company's policy towards licensing is very much affected by the Managing Director's experience some years ago with a process which he developed through 'in-house' R & D but which it was later discovered could have been obtained under licence from a French company for a relatively small licence fee. In this case, over £50,000 worth of development money was spent and nothing tangible resulted from the work. A licence to use the similar process could have been obtained for less resources if the company had not decided to try and develop the process itself. The other important reason for the company being interested in possible new product opportunities via licensing was stated to be because the industry is, in the words of the respondent, a "young industry where innovation is occurring all the time, and where it is important in order to maintain competitiveness with other firms to sometimes consider licensing as an alternative to new product development based on 'in-house' research". The company has had few problems with the licensing agreements that it has been involved with, and is therefore keen to continue this form of new product development and acquisition.

According to the respondent, Company Ds' success in licensing is mainly because the technology concerned is essentially a simple technology which involves a low level of skill. However, it is interesting to note that in the case of the first licence agreement signed by the company (which is now null and void) the technology that was transferred concerned a large item of capital equipment and licensing of know-how in utilising this equipment. Consequently the agreement necessitated the licensor bringing the equipment on stream before the deal was concluded. The central feature therefore of that agreement was not the licensing of a particular product but the satisfactory installation of a piece of equipment. This might support the hypothesis that licensing can be facilitated when processes are capital intensive and where that capital intensity has replaced "on the job" skills which themselves may be very difficult to transfer.

Another aspect of licensing in the industry was stated to be large primary producing companies developing new processes which can use the intermediate products that they produce. Consequently companies like Shell and ICI might develop processes for downstream use which can use the polystyrene foam that they produce in large quantities. Indeed they were stated specifically to go out of their way to do that and in this context may license out up to 50 potential licensees who would use that particular licence process. Company D has not been involved in this type of licensing, however, although one potential licence was evaluated but discarded after evaluation. In such instances, the costs of evaluation and negotiation in terms of management time had generally been relatively low for the company although the respondent did recognise that such costs could be high in some cases.

Negotiations had taken the form, in one of the licensing agreements, of a contract and sets of heads of agreement, "toing and froing" between licensor and licensee until a satisfactory set of heads of agreement had been achieved for both parties. This had been a long term (15 month) process and although a satisfactory agreement had been reached, valuable time in introducing the product had been lost.

The company had also considered alternatives to licensing in acquiring technology. One case concerned the potential takeover by Company D of a firm which was involved in selling 'turn-key' operations for a plastics based process outside the UK. Company D wished to obtain part of this technology and consequently was prepared to consider acquisition in this case, since the owners of the firm were not prepared to consider a licensing agreement. In this negotiation Company D used a firm of solicitors who had been associated with the company since its inception but who were not recognised or specialised licensing solicitors. They feel that the service they got from this group of solicitors in this case and in other licensing agreements has been satisfactory and has not caused problems. Once again, this may possibly reflect the type of technology involved and the relatively accepted part that licensing plays within the industry.

Although licensing only accounts for 5% of turnover in Company D, it has, and continues to be, an important factor in the company's new product policy. Few problems appear to have been encountered in this process and this possibly reflects the low technology profile and the formulative aspect of the products concerned. However, the company has neither considered nor attempted to license 'out' its own technology, and cannot therefore be considered to be using licensing as part of its strategic management of technology. Company D appeared to be satisfied with the success of licensing however, and provides an example of a successful inward licensing company in the context of this study.

COMPANY E

Respondents: Managing Director and Technical Director

Company E[1] is a company in the industrial filtration supply industry. It provides a range of approximately one hundred products to mainly industrial companies and also has important products in the horticultural and agricultural industries. The company was originally the UK marketing subsidiary of an American filter manufacturer. However, the US company decided to divest itself of its European subsidiaries and utilise agents rather than rely upon direct sales with its own sales force. Company E was offered to its managers on the basis of a bank funded management buyout. It was agreed that the company would continue to act as agent for its original American parent. At the present time the company employs forty people with a 12 million pound turnover.

Soon after its formation as a private limited company, management made the decision to broaden the company's product range. At this time it had no manufacturing facilities at all, although a small percentage of the components for the US equipment it sold were produced on a sub-contract basis within the UK. These were generally spares and small parts. The company also had a small R & D (rather development) department which had previously been utilised in getting type approval for US equipment.

Following its decision to diversify, the company took on agencies

(1) Company E was identified through the 'Leverhulme' research described in Chapter 6.

for other American and European products. However, this was seen as only the first step in a major expansion scheme that management had undertaken. Following this decision, a consultant approached the company and was contracted to seek further suitable products which might be produced by the company. Management had an open mind on the type of products that might be made and the consultant's brief was therefore fairly broad.

The consultant identified several products that might be suitable for the company, and one of these was a system for drip feeding plants, developed by an Israeli company. The system comprised a porous hose that delivered a measured amount of water to plants along its length, based upon the pressure of water impinging upon the hose. The company recognised the potential of the product, although it had no skills in either the market or the production of the product. Agreement was therefore reached to import the product from Israel initially. This process worked well, and Company E built up a large and increasing market for the product. It was a company policy to carry out no manufacturing 'in-house' although the firm did carry out a small amount of final assembly work. The production of the product after transfer to the UK was therefore carried out through sub-contractors in the UK. This policy was successful and production of the product is now wholly carried out in the UK. Company E has developed a completely new market in a diversified manner and at present is seeking other products which can also be produced in a similar manner. The company has increased its R & D facilities to be able to develop any future products that it licenses 'in'.

Company E utilised licensing in a very proactive manner, recognising the role that technology transfer could play in its diversification processes. By utilising both the R & D and the marketing facilities of its licensor company it developed into a new market in an incremental manner, building on previous marketing strengths and developing sub-contract manufacture at the same time. Licensing has been an integral part in the company's development from an agency operation to its present position as an intermediary manufacturing/assembly operation. However, the company recognised at an early stage the value of some 'in-house' R & D expertise and therefore developed such expertise to allow it to develop bought in technology for its own markets.

COMPANY F

Respondents: Managing Director and Technical Director

Company F[1] was set up in the mid 1960s as an entrepreneurial venture and collaborative agreement between a venture capital company, an already established medium sized engineering firm, and a group of three engineers. Working capital was provided by the venture capital company, premises and some managerial skills by the engineering firm, and technological skills by the engineers. The objective of the new enterprise was to enter the, then fast growing, heating, ventilating and air conditioning market. After a somewhat problematical first year, when substantially greater losses than anticipated were incurred on operations, the company entered a period of sustained growth and profitability, doubling its sales every year over one five year period. In 1972 the company passed sales of a million pounds a year at which time it attracted the notice of a large conglomerate engineering company, seeking to diversify its interests into fast growing smaller companies. At this time the original venture capital company sold its majority stake to the conglomerate.

Following the change in ownership a number of key staff left the company which, however, continued to grow, albeit at a slower rate than previously. In 1976 however, the conglomerate company

(1) Company F was identified through the Leverhulme research reported in Chapter 6.

incurred heavy losses as a result of problems in one of its largest subsidiaries and went into liquidation in early 1977. Company F as a profitable subsidiary, was sold as a going concern to another, smaller conglomerate, which has owned the company ever since. Over the last eight years company F has been treated as a profit centre, subject to extensive autonomy in its strategic development.

At the time of its first experience in licensing, Company F had a range of six major product lines, with on average ten separate products within each line. Following its last change of ownership the company was rationalised, three of its factory units were closed and production concentrated in Southampton, suitably placed to service its main markets in the South of England. It currently employs nearly two hundred people at two locations in this area.

As market leader in two of its product lines the company has had to innovate continually in what is not, generally, a high technology industry. Heating and ventilating products are not very amenable to export, particularly to very distant markets, because of their high weight:value ratio, although within Europe the company has had success, particularly with one air conditioning product which it has exported to most countries in Europe. Since the industry is very fragmented, company F's strategy has been to concentrate its operations in particular, small, market segments, where it has been able to become a market leader. New product development has generally been incremental, in the context of industry norms. However, in the mid 1970s, the company decided to diversify and enter a new market segment in which it saw great potential, but had no suitable technology.

Following its decision to enter the new market, Company F considered whether to develop technology 'in-house', through research under contract, or through a licensing agreement. Its 'in-house' R & D facilities were relatively poor, restricted to draughting, design and carrying out incremental improvements to existing products. Use of contract research to develop a new product was seriously considered, but ultimately discarded because the costs were considered likely to be too high. The third option, a licensing agreement, was chosen as the best way of proceeding, stimulated by a visit by several company personnel to a trade fair in the United States, where several innovative products had been seen. Approaches were made to three American manufacturers and agreement was reached for the technology for a heavy duty, large air conditioning product to be transferred to Company F. The American company was agreeable in principle to a licensing agreement, since it carried out no exporting and was not a competitor in Company Fs market. The technology involved, also made it unlikely that there ever would be any conflict between the two parties. Company F felt, however, that the US company was not really interested in the agreement, seeing it simply as a method of making a 'windfall profit' rather than as part of a long term collaboration. Possibly as a result of this, the negotiations leading to the signing of an agreement took much longer than had been anticipated (eleven months) and necessitated several costly trips by senior company managers to the USA.

As part of the agreement, the American company provided detailed product drawings and patents to Company F. It was not realised until after the agreement had been signed, however, that all drawings would have to be re-drafted to take account of the different measuring systems (Imperial and Metric) employed by the two companies. To this end, Southampton University was employed to provide extra draughting expertise (this was provided privately, and cheaply, by the individuals concerned). Another problem, which at one point nearly caused abandonment of the project, was the difficulty in finding component suppliers in the UK. This problem was solved by having components sent from the United States in the short term, with a UK manufacturer tooling up to provide the components in the longer term. (For one particular component however, this solution proved impracticable and it is still being imported). A further problem involved the size of the product housing which had to be galvanized. No sub-contractor able to galvanize such a large unit could be found and eventually a special tank had to be paid for by Company F. When the product did go into production, Company F discovered that the marketing literature provided by its licensor (and which it had intended to use 'verbatim') was unsuitable for distribution in the UK and had to be reprinted.

The problems with the product delayed its launch (by about a year) and added substantially to its cost. By 1983, the new product had still not achieved the potential originally hoped for it. As a result, the company does not feel it has had a successful licensing experience and is dubious about repeating the experience.

In summary, Company F realised that it had the choice of licensing, 'in-house' development or employing contract research consultants at an early stage in its new product process. It decided on a licensing strategy as a result of its perception that it did not have the resources to carry out the other options. Thus it saw licensing as a method of obtaining a product cheaply. In its initial evaluation, Company F made a rational decision. It would probably have been unable to enter the market segment in question without the use of licensing. However it was perhaps unlucky in first choosing a licensor with no real interest in a long term agreement and second, in encountering substantial problems in transferring the technology. However, the latter problems, at least, could probably have been foreseen and the company now recognises several of the decision points at which it should have required further information and assistance from its licensor.

Company F has had only a partial success in transferring technology. This appears to have been due to its lack of experience in the use of licensing per se. The Managing Director implicitly recognised this and suggested he would use licensing in a different way, if the situation arises again, by obtaining a more 'clear cut' undertaking from the licensor to assist in overcoming initial technical problems associated with an agreement. However it was clear that the poor result of the first licence agreement had made the company unwilling to consider the use of licensing again.

COMPANY H

Respondent: Managing Director

Company H[(1)] was set up more than fifty years ago as a division of a medium sized engineering group, to manufacture and distribute domestic and industrial fluid and electrical control systems. The company's present status as a limited company, however, dates to the mid 1970s when the original parent company sold the division to another group as a going concern. At that time, the company was restructured and functions previously carried out by 'group' personnel were transferred into the company. The company now operates in an autonomous fashion, with control being exerted by the new owners through a financial regime. At the time of this case study the company employed approximately two hundred and fifty people.

In 1978 there was an extensive programme of reorganisation within the company which led to a number of small manufacturing facilities in remote parts of the UK being closed, and key staff transferred back to the main site near London. A disproportionate amount of time had previously been spent by management in endeavouring to run a disparate group of factories, a legacy of the original divisionalised company structure. This rationalisation allowed management more time to concentrate on the company's 'core' activities, its most important markets, and developing product

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(1) Company H was identified through the 'Leverhulme' research reported in Chpater 6

portfolios to be sold into those markets. The company's products are 'traditional' (in the sense that there has been only a small amount of technical change over the past twenty years) and the company has a large number of repeat customers who incorporate Company H products into their equipment. Recently, however, new control technologies developed in Japan and the United States, have brought new threats to Company H. This situation has been exacerbated through market entry by other, aggressive competitors within the UK. Company H is currently struggling to protect its market share while endeavouring to meet technological changes which threaten to make its current products obsolelecent.

The Managing Director of Company H recognises that his company's current generation of products relies on high skill levels in manufacturing operatives. However, new technology is threatening to make these skills redundant. Company H has recruited more R and D personnel in an endeavour to increase the pace of technological development within the firm and to develop new product lines. At the same time, the method of manufacturing operations is changing, with fabrication utilising micro-chips replacing the previous manufacturing processes in some cases. The process conforms to the change from an electromechanical to an electronic range of products. Company H is therefore, changing rapidly in response to the technological threats and changes around it. However, recognition of these threats was delayed. The company has been forced to withdraw from some markets and halve the workforce to its present figure. The company has made substantial losses in the past two years and this reflects, in part, the contribution of products that are likely to be superseded within the next five years. It was therefore a priority for the company to develop new products quickly. It is in this area that licensing has been considered.

Company H turned to licensing in a very reactive manner. The major objective of the licence research was to identify products that would take up spare capacity within the current manufacturing facilities rather than as part of any integrated new product strategy. The company sought products to inward license in two ways. First, it employed a licensing consultant to identify possible opportunities. Secondly, it carried out its own 'in house' research utilising previous contacts in the United States and a broad based literature search in the United Kingdom.

At the time of this case study, approximately eighteen months after the search process had been instituted, the company was making no products under licence. The consultant employed by the company had made a relatively large number of contacts, and company personnel had also made contact with a number of companies in North America. Although several visits to the USA had been made, and agreement nearly secured in two cases, no licence agreements had been reached. The Managing Director suggested that the main reasons for the failure of the company to identify suitable products, were twofold. First, a major problem had arisen in identifying products that would be suitable both for Company H's manufacturing facilities and for incorporation into its customers' products. A second problem had involved a lack of management time. The Managing Director carried out a majority of the licence negotiations himself and had had problems in delegating the licence function to others. A majority of his own time had had to be spent in the rationalisation process that the company had undertaken. As a result of this process the company was now breaking even and it was hoped that it would move into profit shortly.

In conclusion, Company H had developed its inward licensing strategy in a very ad hoc manner and as a reaction to a lack of new products developed 'in house'. It had approached the practical business of obtaining licences without committing sufficient resources to it. As a result, although it had identified several potentially profitable projects it had been unable to carry them through to fruition. It appeared that Company H may also not have been particularly attractive as a partner for potential licensors, since the company was in the middle of reorganisation. During the licence search period, Company H had substantially strengthened its 'in house' R & D facilities. The Managing Director suggested that his future licensing strategy would be to concentrate on products that the R & D department could adapt and develop rather than seeking 'off the shelf' products to take up spare capacity.

COMPANY K

Respondent: Technical Director

Company K [1] is an old established firm in the hydraulic engineering field. The company was founded in 1860 and has continued to specialise in manufacturing heavy hydraulic equipment. This comprises heavy duty presses with a maximum pressure of 3000 tons. The company has occupied a small market niche for most of its existence, and this has provided a secure though unremarkable profit level for more than one hundred years. The company is well known within its industry, and has been a market leader within its own market segment. However, as new sources of technology have been developed, the company has gone into a long period of decline. This followed sale of the firm by the original family shareholders in the late 1950's.

Twelve years ago, a large conglomerate purchased the company and has since attempted to rationalise the firm and turn it round from its loss making position. This has led to a number of different managing directors being appointed for short periods. This process has reduced the morale of the company workforce. Company management attempted to change the style of the company by moving out of 'one off' heavy presses with the objective of developing a range of lighter presses. Two product areas were identified as potential growth markets. Management considered that development of standard ranges of machinery would strengthen the company's

(1) Company K was identified through the 'Leverhulme' project reported in chapter 6.

position in relation to its market and in relation to the Group. The two product areas chosen for diversification were extrusion presses and concrete presses. Both of these product lines were 'batch' machines, rather than the individually designed machines of previous product lines.

The rationalisation process involving production of standard machines developed slowly. Each of the Directors had particular projects they wished supported and this led to a failure to agree on one overall strategy. As a result of this, the rationalisation process proceeded relatively slowly.

It was clear during the case study interviews that there was considerable friction between company managers. The Technical Director, for example, clearly felt that the current Managing Director, while a fairly dynamic character, was likely to diversify into areas away from the basic strengths of the company. He suggested that this situation may be common in subsidiary companies where group headquarters try to control subsidiaries by putting their 'own men' in at the top.

In 1979, management realised that a further rationalisation had to take place; the Technical Director was made Special Projects Director and new product/market development became his full time responsibility. As a result of this he developed a strategy to build up ranges of the two product lines mentioned above, i.e. powder metal presses and concrete presses. First of all, a licence was taken for a powder metal press and process, which was being relinquished by another UK company. This product and process was approximately 40 years old and the technology was well understood. The press was sold under the name of the 'Stokes' press and the brand name itself had a certain value within the UK since it was recognised by customers as a particular type of technology in a generic sense. There was only one other producer of similar machines in the UK, two European companies and three United States companies. Company K used the technology acquired to develop a range of machines around the original Stokes press. This process is still continuing with the objective of creating a range from very small to very large presses (up to approximately 100 tons). The 100 ton press is large in relation to the powder metal process but not in relation to hydraulic presses in general. Products that can be produced utilising this technology include automotive components and locks, and it is used as an alternative to casting processes. A much better finish is produced than castings can provide however, although die casting and investment casting can be competitive in some cases.

The new process also allowed company K to produce exotic alloys, since a mixture of several different metallic powders could be made with the pressing action causing them to melt together into an alloy. Quite complex components could be made using this process. A major problem of the new range of machines that the company produced however was in marketing. The marketing department was skilled in negotiating projects with clients up to a million pounds in value but was not so effective in selling a semi-mass-produced range of products. New people were therefore recruited to handle the sales of these new products.

The other major product line which the company licensed 'in' was concrete block making machines based on the 'wet concrete' system. The new concrete process had many applications in the Middle East and third world countries, particularly where there was a lack of water for mixing concrete since much of the water involved in the process could be re-cycled. However, the concrete block making technology was very new and there have been problems associated with it.

The licence was taken from an American company that did not wish to export to Europe and although the technical backup provided by the licensor has been relatively poor, the product has now been launched in the UK and is proving relatively successful. However, its long term future still does not appear completely secure.

In conclusion, although company K has utilised licensing in a pro-active way, its role within the development of company strategies has been somewhat haphazard. The new product lines that the company has decided to produce have arisen more as the result of individuals wishing to enter markets than within any corporate plan. However, the effect has been positive in that the company has diversified away from its previous narrow product lines and into products with a good potential in the medium and longer term.

COMPANY L

Respondents: Managing Director and New Product Manager

Company L [(1)] is part of a major, British based, diversified international group of companies, mainly concentrated in the aerospace and other defence industries. Group companies supply sophisticated components for aircraft and other products. The company was founded more than thirty years ago as a private concern, by two entrepreneurs, and has had a history of regular although modest expansion both in turnover and the fields in which it operates. At the end of 1982 the company employed just over one hundred and fifty people, having grown from slightly less than one hundred employees in the ten years following its takeover.

The company has major divisions based upon its skills in three product groups, metal stampings, flexible electrical harnesses and printed circuit boards, and electro mechanical components. Many products are produced in close co-operation with the UK Ministry of Defence, a major customer. This category of work comprises the largest section of the company's business. Although the three divisions carry out some common contract work, they are based upon three different technological competences and, while this has been a company strength, it has also caused problems in making decisions on which of the divisions should receive investment funds.

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(1) This case study in amended form was published in Lowe, J and Crawford, N K 'Innovation and Technology Transfer for the Growing Firm', Pergamon Press 1984.

The company's concern for licensing began in 1980 when there had been a moratorium in defence spending by the UK government and this had meant that companies such as company L, for whom defence work accounted for a large proportion of their turnover, were likely to be under some commercial pressure. Consequently, the managing director set out on a policy of actively trying to license-in products for the company to make, which would utilise existing manufacturing and marketing skills and would substitute for some of the electro-mechanical work that was done for defence contracts. His objective was to diversify the company from its current product range. His first alternative had been to carry out new product development 'in-house' and indeed, the company had a sophisticated research and development section, set up to work on substantial defence contracts the company had acquired. However, the Board of Directors realised that it could not use this facility as a sole way of bringing in new products because it would take too long. Whilst the company, at that time, did not have a cash flow problem, it did recognise that there were likely to be severe problems in future. The first action that the managing director took was, therefore, to employ an independent licensing consultant who abstracted information on a regular basis from the London Patent Office and other sources of new products. The licensing consultant had been given a checklist of criteria by which the company wished to have potential products and licensors selected.

In addition to using a consultant the managing director also embarked on investigations of his own, looking for companies which were near to bankruptcy because of lack of cash but had good ideas and good products. His objective was to purchase the whole of the company, discard the pieces that were not required and integrate the parts that were useful into his own organisation. He approached Dunn and Bradstreet but this company was unable to find him companies about to go into liquidation in specific industries in which he was interested. However, he managed to locate several companies in which there would be an interest in acquiring either part or all of the company, but in none of these cases was he able to persuade the shareholders to sell, or the key employees to move. Consequently he changed his strategy and decided to license a product in, while continuing his interest in acquisition as an alternative.

In order to execute his licensing policy the managing director recruited a recent engineering graduate (with two years industrial experience) as his New Product Development Manager, to search out and find potential licensing partners. The major task of this individual was with the licensing aspect of the business. For the first 18 months of his employment with the company he was concerned with identifying information on licensing opportunities and learning the licensing business. His usefulness to the company over this period was, therefore, rather low. The New Product Development Manager pursued the objectives of finding a licensee in various ways. He continued to employ the licensing consultant for the rest of his first year's contract. He used the set of criteria drawn up by the Board of Directors to help evaluate the ideas that came from the licensing consultant and other sources. These were then passed on to members of the Board of Directors for further evaluation. In addition, he carried out research himself. He accessed the 'Dvorkovitz' databank, he got in touch with several licensing consultants and accessed numerous publications. One major source was the various trade journals at the American Embassy which were used to identify the names and addresses of American manufacturers who had production and marketing expertise in the areas in which the company would like to become involved. Subscriptions were taken out for various of these journals. On the basis of the data collected, a large number of companies were approached, to ask if they would be prepared to consider discussing the possibility of licensing a particular part of their product range out to company L. No conclusive agreements had been reached at the time of this case study. It appeared that the New Product Development Manager was not able, from an organisational point of view, to make an impact in this area. He was not really a strong product champion for a role such as the one he had been given.

The company's intention was to diversify out of its electro-mechanical MOD market as soon as possible. This could be either on the basis of its marketing or production strengths. One major constraint was that the new product should fit in with the existing production skills of the company which were not always suitable for the new products under consideration. A further problem was that any new product would also, initially, have to be sold by the company sales force which had extensive skills in selling to major companies and organisations such as the MOD but was less skilled in selling to a larger number of smaller customers.

Management in company L saw technology licensing as a key item in its strategy to diversify out of current product areas and into other fields where all its technological strengths could have a bearing on company performance. However, the approach to licensing was carried out in a relatively haphazard manner with many different products, from several technological areas, being considered at one time. While this was clearly advantageous in seeking diversified products, measures of those products against technological skills did not appear to take place early enough in the search process for obviously unsuitable products to be discarded.

Company L attempted to use technology licensing in a highly proactive manner, but the results of this approach had been disappointing. The strategy appeared to be weak in not recognising the limitations of the licensing approach and setting specific objectives early enough in the search process. Where potentially successful products had been identified, entrenched coalitions of interest within the firm frequently overrode the strategic objectives set by top management, in failing to accept new product ideas.

COMPANY M

Respondents: Managing Director and Marketing Director

This case desribes company M [1], a small innovative and extremely fast growing company based in Oxfordshire. The company was set up in 1974 by the present Managing Director who has a background in civil engineering. At that time he was working for a Government research laboratory, the Transport and Road Research Laboratory (TRRL) where he met two other electronic engineers. They recognised that a variety of inventions and ideas were being developed by the laboratory but were not being developed into successful products but remaining in prototype form.

The engineers set up a company to exploit one of these products, a traffic flow monitor, under licence. The product was designed to count and record vehicle traffic flows for later analysis. The prototype vehicle monitor was a very bulky instrument however which required several car batteries to operate and was therefore not very portable. The second generation instrument developed as a first product by company M, however, was extremely compact, worked from a small re-chargeable battery and was fully portable. On this product the initial success of the company was based.

Since 1984 the company has grown at an increasing rate and is currently expanding at a rate of approximately seventy percent per annum. The company now employs more than thirty people, of

(1) Company M was identified through consultancy work in 1983.

whom eight are employed on Research and Development and four in a sales office in the United States. The R and D personnel are mainly employed in the development of new products for the company, but also carry out work under contract for other companies.

Following its initial success with the traffic flow monitor product, company M returned to its original licensor to seek new products. Two more pieces of technology were identified that appeared to have potential, and one of these, an instrument for classifying vehicle types as they crossed an under-road sensor, was licensed. This product complemented the original product that company M had licensed from TRRL. The company also identified a second product from another Government laboratory, an instrument for measuring liquid flows in a pipe. In both cases the technology was licensed in, in prototype form, developed by the company, miniaturised and launched as a product. In one case the development of the product was initially carried out under a Government grant. In all cases the impetus towards the licence came from the company rather than from the publicly funded body in question.

Neither of the two licensors had outlicensed any technology before setting up agreements with company M. However, they recognised that licensing might be a useful method of commercialising some of the inventions coming out of their laboratories. The licensing negotiations were carried out in rather an ad hoc manner however. The first agreement, for example, was based on a single sheet of paper and contained omissions which might have led to problems at a later date. However, both parties were already working together and committed to co-operation and so problems did not arise.

A major problem in negotiations for the first licence was the royalty rate demanded by the licensor for the use of his technology. This was based on a non-exclusive licence and a 6-8% royalty rate, presented on a 'take it or leave it' basis. While the first licensor insisted on a non-exclusive licence in writing, in practice it had given undertakings (sometimes in writing) to provide an exclusive licence. The reason for this appeared to be pressures on publicly funded laboratories not to make technology available on a 'one customer' basis. Another problem was a requirement by the licensor that all inventions or developments of the technology undertaken at the cost of the licensee remained the industrial property of the licensor. This was clearly an onerous clause which was entered into reluctantly by the company on the basis that it needed the technology at that moment more than it needed any developments that might come out of the technology. A third problem was a clause requiring company M to make equipment available to the licensor for disclosure to a second licensee, a competitor of company M.

Despite the problems noted above, it is the intention of the Managing Director to use licensing in the future as part of his planned strategy to develop into new areas both by diversifying vertically into the production of some of the component parts which are used in the present generation of products and horizontally into new markets. One possible new area for this is in the development of a range of vehicle weighing machinery, the technology for which is available once again from a public utility. The Managing Director makes the point that the fact that the company is presently acting as a contract research and development firm for the utilities gives it a number of possibilities for licensing technology in. This is particularly important where a client has had development work done and the company realises that a spin-off product from this technology is going to be possible.

It is also the intention of the company to use licensing 'out' in its market development policies. At the moment the company uses a number of agents on the Continent to sell its products and although this has generally been satisfactory the company now believes that licensing agreements might be more effective because licensee companies may be more likely to develop their markets than agents would. Company M considers itself too small to be able to devote a large amount of resources to export market development and it considers, therefore, that licensing agreements may allow it to exploit a larger number of markets in a short time.

APPENDIX 6.2

OUTWARD LICENSING CASES

<u>COMPANY N</u>

Respondent: Chairman

Company N[1] was set up in 1928 to supply heating and ventilating products. The company built up a reputation over the pre-war years as an innovator within its industry. Following the 1939 - 1945 war in which defence contracts increased the company's turnover, the company turned increasingly to exports as a method of market realisation and as an alternative to the UK market. This policy was successful and by the early 1970s the firm was exporting in excess of 60% of its output from two factories. At the time of this case study, the company employed just over two hundred people.

In 1978, a national stike was called in the engineering industry, by the AUEW.[2] Most of the employees at company N belonged to this union and consequently, went out on strike for two days per week. The strike came at a particularly critical period for the company, with a number of large export orders being fulfilled. The Managing Director [3] of the company appealed to the workforce to show loyalty to the firm but this appeal went unheeded. He therefore closed the factories down and decided that the company would carry out no further exporting. This led to the closure of one of the two factories

(1) Company N was Identified through the Leverhulme research reported in Chapter 6

(2) Amalgamated Union of Engineering Workers

(3) Now Chairman

and the rationalisation of the other, to approximately half its original workforce. The strike experience led directly to the decision by the company to substitute licencing for its previous policy of export.

Following the ending of its export business, the Managing Director visited a large number of countries where his company had previously exported. He had not previously had any experience of licencing, however, and this led to a number of problems initially in reaching agreements with potential licensees. The initial licence agreements were for the companies' full range of heat recovery plants, previously exported. Although this technology was not patented, there was a great deal of 'know how' involved in its successful implementation. Thus the technology was protected to some extent and this protection was also enhanced by the design copyright of the company on a number of components of the product range.

The company approached potential licensees to sell its technology. Frequently, previous importers of the technology took on the product on the basis that it could be made locally. In other instances, company N made the first approach to potential licensees. These were chosen on the basis of size. The largest company in a particular market was never chosen, but usually one that was smaller or wished to diversify into that market.

As a result of its efforts, company N now has licensees in more than twenty countries around the world. The policy of licensing has led to an increase in the number of countries in which the company is represented. Turnover has increased as a result of the change and the profitability of the company has also reached a new high. The company has ploughed a large proportion of the income accruing from its licensing activities into a research and development programme which has resulted in a new generation of products which has also benefitted its remaining customers in the UK. Licensing has been a major benefit to company N and ceasing manufacture for export has allowed the company to reduce its overheads and increase its research intensity while increasing its profitability.

In conclusion licensing by company N arose in a very _ad hoc_ manner and in reaction to an unusual situation. However, the company recognised that it had a _technological_ advantage and that manufacturing was only one method of exploiting this advantage. Soon after commencing licensing operations, it realised that the sale of technology _per se_ was a more effective method of doing business than its previous method of manufacture and direct export.

Company N acted in an extremely flexible manner to take advantage of oportunities that arose for it. It used technology licensing without having had any previous experience of the technique. However, its technological advantage meant that it had a very saleable product and this probably accounts in large part for its success. The company utilised licensing to generate income which it then ploughed back into R and D. As a result it has retained its position of technological leadership, although utilising a different method of market realisation.

COMPANY O

Respondents: Managing Director and Marketing Manager

Company O[1] was launched in the late 1960s by an entrepreneur with experience in the ferrous castings industry. This individual had patented a process whereby resin could be used to seal flaws, holes and voids in castings. The company set up a number of 'job shops' to process castings for the automotive industry. The process involved a stable polyester resin being impregnated into the casting being processed. This was done by immersing the casting in the liquid resin, with heat curing taking place after total impregnation was complete. The process was rather time consuming however, utilising a two hour production cycle.

Although the company was successful on a small scale, the volume of business available on a 'job shop' basis was limited. It was recognised by management, however, that a method of integrating use of the process into production lines would open up huge markets for the company, particularly in automotive foundries, where the failure rate for engine block castings (for example) was running at a rate of approximately thirty percent. Reduction in failure rate by the post casting impregnation of resin would be a substantial bonus to foundries. Development of a new generation of high pressure impregnants was therefore set in hand by the company and after a two year development programme this resulted in a much improved

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(1) Company O was identified through the Leverhulme research reported in Chapter 6

fast turnaround system. The major advantage of the system was its speed, compactness, high effectiveness, low capital cost and potential for incorporation in casting production lines as a standard process and not merely as a method of recovering 'failed' castings. The system was introduced into the company's UK 'job shop' operations and quickly demonstrated its effectiveness. As a result of this, a number of large companies purchased the process for inclusion in their plant. Following this success the company expanded, and currently employs 50 people.

At the time of developing its new patented system, company O did no exporting, since its 'job shop' operations were not amenable to this market. However, the company recognised the potential of its system for use by overseas manufacturers and therefore considered how best to exploit its advantage. As a small firm, with few resources for capital investment in overseas markets, the company felt that it had no alternative to licensing if it was to obtain a quick penetration of all the markets in which it saw potential. The UK 'job shop' operations was continued, however, but on a smaller scale, with numbers of licensed operators given the right, within the UK, to use the company's process. These operators signed a five year agreement to obtain chemicals for the process from company O, which was able to charge a premium price for them. Process machinery was supplied to each operator as part of the 'package'. A similar formula was developed for export markets, although here, licensees were used, rather than 'licenced operators'. The company set up agreements in many countries. The form these agreements took varied from market to market, but usually the local licensee was given assistance to produce plant/machinery to set up a treatment operation and sell process plant locally, providing the speciality chemicals. It was in this way that the company made its return. Since the process was a very profitable one for licensees, company O was able to draw up extremely restrictive licence agreements. These were normally for a maximum of two years. However, clauses were included allowing the licensee to renew the contract if a reasonable rate of sales had been achieved during that initial period.

Following the policy change, and introduction of the new technology, company O became more of a marketing than production company. Senior executives spent a majority of their time travelling, either seeking new potential licensees for their product or in visiting existing licensees. The company sees a close relationship with its licensees as being extremely important in motivating them to produce the best possible results. This seems to have been a successful strategy and the company, as a result of these operations, has become extremely profitable. However, this profitability has led to competitor companies (with different processes) entering the market. A majority of profit has therefore been ploughed back into research and development to retain the company's technological lead.

In conclusion licencing has been the major tool for the company's expansion and success over the last ten years. The basis of the company's success, a patented process involving a great deal of secret 'know how', has allowed company O to become extremely profitable. The main product of the company has been used very much as a 'cash cow' (in BCG[1] terminology) and has allowed the company to expand successfully into worldwide markets, even though it is very small. Company O has recognised that its one major product makes it vulnerable to competitors, however, and has used the cash from exploitation of this product in developing new process technology.

The company has utilised the exploitation of both patents and trademarks as major plants in its product/market strategy. It now has a worldwide reputation as 'market leader' under its own trade name, and this has also allowed it to keep a certain control over its licensees, since it has the option of recovering that tradename. Patenting has also been used successfully to prevent competitors entering the market, although patent costs were initially a major strain on the company's resources.

Company O appears to be a good example of a firm which has recognised an opportunity and exploited it through licensing. This has been in a very opportunistic manner, however, since it was the success of its initial process which led it to recognise the potential for its products on a worldwide scale and hence because of the constraints upon it, to make use of the licensing option.

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(1) Boston Consulting Group

COMPANY P

Respondents: Managing Director and Marketing Director

Company P[1] was set up in 1965 by three individuals who saw an opportunity in the market for sprayed powder coating machinery. The company was the inspiration of the present Managing Director who was working, at that time, for an engineering firm which produced small numbers of similar machines (although this was not its main business). He recruited two colleagues and together they set up company P to compete with their former employer.

The company produces a range of sprayed powder coating machines which work by imparting a static charge to the product to be coated, onto which the powder is then imparted. Main markets are in the automotive and processed food industries and the number of uses for the technology, which is an alternative to other forms of painting and coating, is increasing. By building upon its success in the UK, the company has become a world leader in the application of powder coatings and is now market leader with more than 50% market share. Since the technology is an improvement over competitive techniques, the company finds itself in an expanding market. It has to invest a large amount in R and D to retain its competitive lead. It is company policy to patent as many techniques as possible and to patent in all its markets. This has proved expensive, but has allowed company P to protect itself from competition throughout the world. At the time

(1) Company P was identified through the 'Leverhulme' project reported in Chapter 6

of this case study, the company was still owned by the three major shareholders and employed about 50 people.

Company P has utilised technology licencing as an alternative to the use of sales agents in many overseas markets. Generally it prefers to utilise direct export through agents where possible, but in may cases this has not proved to be feasible. In some instances the company has been unable to export to a country because of tariff barriers erected by Governments locally. In other cases, the size of the market justified a local manufacturing facility which company P did not have the resources to develop and hence it turned to licensing as an alternative method of market realisation.

The company has utilised licensing to enter markets through existing local companies with the longer term objective of entering the market as a producer itself. It recognises the danger of setting up competitors in those markets. However, the Managing Director considers that the amount of money spent on R and D within the firm, a large proportion of which is funded from licensing activities, is sufficient to retain a competitive advantage over other companies.

Company P has utilised licensing for the complete range of its products with the objective of providing local licensees with a total technological capability. This sets up local licensees in the most effective way for exploiting their markets. In many cases, the local licensee has been unable to produce all the component parts of the product 'in house' and in these cases, company P has been able to exert a degree of control over licensee operations by component supply. Company P finds this situation advantageous because it considers that a close relationship with its licensees is important in achieving maximum market penetration. However, the technology that company P licenses 'out' is usually one generation older than those products being sold in its own home and export markets. Company P has, therefore, been careful not to sell its latest ideas, until these have been successfully exploited in its own markets. Since a majority of the industrial property involved in its licence agreements concerns 'know how' rather than the transfer of patents, design etc (although these are also important), company P has set up a group of individuals within the firm whose major responsibility is to service the requirements of its agents and licensees around the world. This 'servicing' requirement also assists in the control of its licensees and in identifying suitable technologies to obtain under the 'grant back' provision of its licensees.

Company P's management decided at an early stage in the growth of the company that they would endeavour to exploit their products on a worldwide basis. There were several reasons for this, but the major one was that the UK market for the technology was too small for them to generate enough income to be able to retain their technical lead. Exploitation of the technology had, therefore, to be made on an international basis and to this end, all forms of market penetration were used. Income from early licensing agreements, particularly with Japan, altered the thrust of their market exploitation policy and as a result of this, licensing took on a greater role in their operations.

Company P now has a mix of agency and licensing agreements, with direct investment through a subsidiary company in its largest market (the USA). Its use of licensing has been successful in nearly all cases, although there have been some problems in motivating licensees to develop their markets. The income from operations has been ploughed back into R and D, allowing the company to keep its competitive lead. The company is now considering how to develop its strategy for the further exploitation of its technology. R and D has become an increasingly important part of the company's operations, with that expertise marketed as a skill in its own right. In view of management's wish not to grow to a larger size, the company is now considering a long term strategy of exiting manufacturing and concentrating solely on R and D and licensing.

COMPANY R

Respondent: Marketing Director

Company R[1] is an old established family owned company employing approximately forty people, manufacturing pleasure and work boats to a displacement of up to ten tons. The company produces a large number of different designs, but these are usually of the one-off variety and built to the specifications of a particular customer. In the early 1970s, the company decided that it needed to diversify away from commissioned designs and into more standard products. Following this decision, it designed a revolutionary new product. The licensing history of this product comprises the basis of the case study.

The product concerned was a twin-hulled catamaran specifically designed for export markets. The original design was based on the perception that a market existed for a workboat to be used in the estuarial waters of various West African countries. The boat was designed so that it could deal with various adverse weather and handling conditions and could be sold to countries where only basic technical skills existed. The boat comes in a knock-down form ready for simple re-assembly. Initially the company intended selling the boats in kit form, as part of a total licensing package. Various component parts were designed to be substituted through locally sourced suppliers. For example the control cables

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(1) Company R was identified through the 'Leverhulme' research reported in Chapter 6.

could be standard lorry cables available in most countries. More effective but more complex hydraulic systems, were not incorporated. The company spent four years in research and development and getting the boat accepted by Lloyds' assessors. The stamp of approval given by this regulatory body was perceived to be of value in the context of the licencing package decribed below.

The company registered the new design under a particular trade name and placed considerable emphasis in its strategy on its ability to sell the registered name. It was the company's view that this was an important aspect of a licensing package so the difficulties that ensued in registering the trade name were an important facet of this case. The company first marketed the product under its company name and sold one unit to Nigeria under that name in 1977. At the beginning of 1978 an application was made to the Trades Marks Registry to register the new trade name. This application was turned down on two grounds. First, that the company name and the trade name were both descriptive names that could not be registered. They argued that this precluded the company giving a trade name to a product that was in fact merely a physical description of that product. The second reason the trade name was rejected was that another company had already tried to register the same name the previous year. This company had copied the concept of the product and the trade name from company R. Company R employed a solicitor to defend the action for them. However, it was nearly four years before it won its case. The legal problems prevented proper exploitation of the product during that period.

The firm's motivation for wanting to license out the product were threefold. First, as noted above, the boat was designed so that it could be assembled locally. This was because high transport costs and specific local needs would determine the nature of the finished product. Secondly, it was suggested that in those markets for which the product was aimed., i.e. developing countries, import of capital goods was subject to tariff barriers and also to non-tariff quota restrictions. The final reason for licensing was that the company had been unsuccessful in exporting the product. The Sales Director suggested that a lack of finance to develop overseas markets had been the major factor in this failure. The company had in fact obtained several further orders from Nigeria but these orders were not accompanied by irrevocable letters of credit and therefore lapsed.

The company developed a two tier marketing strategy. First, it attempted to sell boats through direct export to potential customers. This marketing effort was aimed mainly at developing countries. In addition however, the company tried to persuade American and Canadian companies to buy the product for use in North American estuarine waters. The second major strand of the company's strategy concerned its attempt to license out the design and registered name in licensing journals distributed on an international basis, seeking licensees. Advertisements were also inserted in specific marine journals. One tangible result of this process was a substantial reaction from licensing consultants who sought to assist the company in its licensing activities. As a result of these activities a Canadian company came to talk to company R but to date nothing has come of this. As a strategy for exploiting the product, licensing has therefore been unsuccessful to date

In conclusion the way in which the company approached licensing negotiations appeared, for a small company, quite reasonable, although identification of specific market targets might have been appropriate. Whilst a strategy of licensing appeared to have been forced on the company by non-tariff barriers, transport costs and local market considerations, the company may have picked the wrong market to try to exploit. The developing countries with poor supplies of skilled labour and quality component parts do not appear to be a fruitful area for outward licencing and possibly more could be achieved in the Canadian, American, Australian and New Zealand markets. Attempts to license 'out' to Europe have also been largely ignored. The reason for this was stated to be the possiblity of competitors' designing around company R's product. However, whilst imitation does present a problem it would appear that in view of the Lloyds' approval and the registered design the company has a licenseable product which could be protected. The problems presented to the company in registering the trade name could be symptomatic of the problems encountered by smaller firms trying to establish the legal rights to industrial property.

Company R has failed in its strategy of licensing. The company is now considering whether to endeavour to attempt licensing to other (eg. North American) markets of to consider other forms of co-operation, such as joint ventures . It has received approaches from several companies to co-operate on this basis .

COMPANY S

Respondent: Managing Director and Technical Director

Company S[1] is a West Midlands based design consultancy with 'in-depth' experience in the fields of engineering, industrial design and new product development. The company is one of the largest 'design' companies in the United Kingdom and acts for many of its clients as a research and development organisation. At the time of the case the company employed more than sixty people and was expanding fast, with a very diverse client list. Although the organisation was a partnership, effective control remained with the founder, and major shareholder, who acted as Managing Director.

In the late 1970s the Company was contracted by the UK Ministry of Defence (MoD) to assist in the development of a new and improved oxygen mask for the use of aircrew in fighter aircraft. The new product had to be designed to very high specifications and particularly tight tolerances, to meet strict MoD specifications. This was a major project for the company which committed a substantial design team to developing a number of alternative designs for approval by the MoD. By the end of early 1981, the company had designed what it believed to be a world beating product that incorporated a number of innovative features. The technical base for these features was made the subject of various patent and registered design protections, both in the UK and overseas, particularly in the USA.

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1. Company S was identified through the 'Leverhulme' research project reported in Chapter 6.

As part of its agreement with the MoD under which the development project was being undertaken, the company had obtained the right to exploit the intellectual property involved,in other markets than the UK. This was an important advantage that had been agreed to by the MoD in view of the wish of the company to exploit its skills in third markets. Following the success of the product in the UK, which had involved the company in producing prototypes and pre-production runs of the product, Company S turned to the possibility of either selling the product abroad or having it manufactured under a licence agreement. The latter option seemed the most logical since the largest potential market (the USA) was dominated by indigenous manufacturers. The USA Defense Department also had a policy of sourcing defence related products from local suppliers which made the possibility of successfully supplying the market with products from the UK, remote.

Following its decision to license its product out, the company approached a university based licensing consultancy to assist it in identifying the best method for exploiting its intellectual property. At the same time it carried out preliminary enquiries with a number of US companies that might be interested in the product. Three potential partners were approached. The first of these was a large company with nearly three quarters of the military oxygen mask market. The second had about ten per cent of the market, and the third was a company that wished to break into this market. The consultants were asked to recommend a suitable strategy for the product.

The consultants recommended that the company should endeavour to set up an agreement with the US company that already had a small share of the market, since they would be likely to 'push' the new product. The major supplier, would, in the consultants' view, be less likely to welcome a new product that competed with its already existing range. However, Company S decided that in view of the better Defense Department connections of the major supplier, it would endeavour to draw up an agreement with them rather than follow the consultants' recommendations.

The major supplier seemed enthusiastic initially, and as a result of this, several of Company S's executives visited the USA to draw up a draft agreement to license the product. However, after two such visits, the negotiations became increasingly involved in matters of detail, such as royalty rates and the ownership of any improvements to the product. Eventually, the major supplier announced that it would need to carry out further tests on the product, that these might take a year, and that it felt unable, over this period to make any form of payment to Company S.

Company S considered that the American company was 'playing for time' and that it had no long term objective of entering any licence agreement. The constant delays and negotiations had, however, given the USA company considerable time to undertake a programme of development around the design that Company S had created. Following a series of increasingly acrimonious meetings, Company S broke off its negotiations with the major supplier and commenced negotiations with the other American company, with the small market share. However a period of nearly one year had elapsed before this happened. At the time of the case, preliminary negotiations were being undertaken with this second company.

In retrospect, the company realised that the major supplier was not interested in a licence, since it already had a product to serve the market in question. However, it seems likely that this company talked to Company S as a method of preventing a new competitor entering the market. This appeared to have been a relatively successful strategy in light of the history of the licence negotiations. It seems probable therefore, that a strategy of licensing a competitive product to the dominant supplier in a relatively small market with few competitors may not always be the most appropriate choice. Possibly an agreement with another company wishing to enter that market or expand its share would have been more appropriate in this case.

COMPANY T

Respondents: Managing Director and Marketing Director

Company T [1] was set up in the late 1950's as a division of a large electronics company. The objective of the parent company was to create a manufacturing facility for internal sourcing of components (magnets) for its main business. As a trading division of a large company, however, company T was encouraged to sell its products both inside and outside the group. In this it was successful, and by the early 1970's a majority of its turnover was accounted for by trade with companies outside the group. Many of these customers were foreign companies and a large proportion of output was exported. In 1975 the parent company carried out a review of its activities and as a result of this, company T was divested, by means of a management buy-out funded by three merchant banks and the National Coal Board Pension Fund. The present directors of the company retain a majority share of the company's equity however. At the time of this case study, the company employed approximately 150 employees and had a turnover of £4.5 million per annum.

The technological expertise of the company lies in the manufacture of specialist magnets of which it is one of less than a dozen such companies in the world. Prior to divestment, the company had established itself as a world market leader in this market. Following divestment, the company was able to take advantage of a

(1) Company T was identified through the 'Leverhulme' research reported in chapter 6.

growing demand for its products and over the past three years it has increased its turnover by more than 100%.

Company T has utilised outward licensing as a planned part of its strategy for exploiting its product lines. The use of licensing can be traced back to the foundation of the company, when an inward licence agreement was negotiated by company T (then a division of its parent) for a particular product. This licence provided the base for one of its major product families. The use of licensing was therefore an integral part of company policy from its inception. Recently, however, the company has carried out no inward licensing per se since its technological base is now very strong. As market leader in its main markets, it has not identified a need to purchase technology developed by others. However, it has obtained technology as a result of cross licensing agreements.

Outward licensing and reciprocal or cross-licensing agreements form the basis of the company's technology policy for exploitation of markets where direct export is inappropriate. This situation usually arises from one of two reasons. Some markets are so competitive that company T is unable to exploit them effectively with the resources at its disposal (as in the case of Japan). In these instances, sale of technology on a reciprocal basis to the local market leader usually allows for a free flow of information between the two companies to the benefit of both. Agreements have been set up with both Japanese and American companies. The type of technology involved is usually of an advanced type, and frequently involves the application of particular techniques (or 'know how') rather than designs or patented technology for a particular new product. In some cases, part developed technology has also been involved, leading to collaborative efforts on further development. Company T has also collaborated to commercialise developments which have arisen in University research laboratories.

The second major destination for outward licensed technology has been in those markets which are protected by tariff barriers. These markets have usually been in less advanced countries where the technology involved was less sophisticated than in the UK. Several agreements have been made with Indian companies to sell technology for the mass production of low technology magnets, but with a large volume manufacture potential. Company T has utilised these agreements both to provide it with a royalty income and as a source of product for particular market segments.

It is a policy of the company to concentrate its resources on the development of 'high technology' and specialist applications rather than in the area of low technology mass production of magnets, and licensing has allowed the company to move out of the latter markets, while at the same time continuing to obtain a return from them through the efforts of its licensees. The income from outward licensing operations has provided useful development funding for higher technology magnet applications.

It is a major objective of company policy to retain a technological lead in its market and to this end it has been necessary to invest heavily in further R and D. Such R and D is not always carried out within the company however, and several universities have received development funds for new applications of magnet technology. By subcontracting R and D and outward licensing, the company has also been able to confine its growth to an increase in turnover, rather than in number of people employed. The Directors consider that any growth in numbers of employees over two hundred is likely to make the company more difficult to manage, and have developed strategies to develop without an increase in size.

In conclusion company T has utilised licensing in a highly successful manner to support its manufacturing and marketing operations. Licence income from obsolescent technology has been used to provide resources further to increase its technological lead in other areas. This, in turn, has led to other licence agreements with direct competitors on a technology exchange basis. Thus technology has been licensed in and out at several stages in the product life cycle including prototype, fully developed and obsolescent technology, in a highly proactive manner.

COMPANY U

Respondent: Technical Director

Company U[1] is a subsidiary of a large, diversified group of companies in the paper, plastics and chemical field based in the West Country. The company makes plastic containers of many sorts and has particular skills in thermoforming and other production technologies. Development of these skills led to the patenting of several new processes which the firm was considering out-licensing at the time of this case study. The case explores the internal management implications of the decision to outlicense process technology.

Company U had been set up as a subsidiary of its parent company to fill in a gap in an area of the plastic container market that was not presently being exploited by the group. The company had been relatively successful in this market segment and had then developed, to employ more than one hundred people by the beginning of 1983. At the time of the case, the company was seeking to expand into a new, highly competitive market segment with a new and innovative product, subject of the new processes noted above.

The company had previously carried out some <u>inward</u> licensing, but the current interest was in the outward licensing of the new packaging product (a plastic can) and its associated production

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(1) Company U was identified through the 'Leverhulme' research reported in chapter 6.

machinery. The product was deemed to be superior to other plastic products because it had a property that most plastic containers do not possess. It could be heated in a retort. Thus vegetables or other foods could be 'cooked inside the can'. Metal containers had always possessed this property, but the new plastic product under consideration here, was unique in this respect. In addition to this advantage, the container was also the subject of a patented label bonding system which reduced the number of processes involved in production line technology.

Intrinsically, the product seemed an attractive one for exploitation either through joint ventures or licensing agreements as a 'technological package'. Direct export of the product appeared to be precluded because of the high transport costs involved. Although the product was more effective and lighter than metal cans, in export markets, this advantage would be more than offset by its higher cost.

Initially, company U set up a joint venture/licence agreement with an Italian food processing company. For an 'up front fee' of £50,000 company U granted exclusive rights for Italy, Spain and six African countries. The Italian company had incorporated the product into its processes and had made substantial cost reductions as a result of the new technology. Company U intended to use the Italian success as a demonstration for other potential licensees.

In the UK company U did not appear to have developed a satisfactory strategy for the exploitation of its technology. It had considered two options. First, a licensing agreement with one of its current customers which was very interested in the new technology. However this company had only a small market share of the container market segment covered by the technology. Possibly a more promising strategy was the consideration of a joint venture with Metal Box plc which was a main competitor with company U. The problems with this strategy were twofold. First, company U did not have large resources to commit to a joint venture company. Secondly, although Metal Box appeared interested in the technology in principle, the product was a direct competitor to its own 'metal can' technology. At the time of the case study, negotiations had already continued for five months and company U suspected that Metal Box might not be willing to give any joint venture project total commitment. A joint venture agreement could be a method of effectively emasculating the new technology.

Company U had also considered how best to exploit foreign markets. In terms of market needs and feedstock supply availability, the most promising target markets appeared to be the USA, Europe and the Middle East, in that order. However, company U had not previously carried out much exporting to these markets and was therefore undecided about the most effective way of exploiting them. Consequently, although they had, in principle, decided to follow the Italian model and license their technology 'out' in this way, they recognised a need for development of a credible strategy for market development.

As with the UK market, two strategies have been considered. First, to define the most promising licensee from a market viewpoint. While some of the American firms seemed to be attractive partners, company U also considered some of the smaller concerns. Its objective was to arrive at agreements with licensees who would exploit their markets most aggressively. At the time of this case study, preliminary negotiations were being carried out with several potential licensees.

In conclusion, the company recognised that it had a problem in devoting sufficient resources to the process of licensing to make a maximum return from it. Although previous experience of licensing had been generally good, company management did not appear to have reliable information on the most effective means of utilising licensing. This may have been due to the high turnover of management within the group consequent upon its centralised management style. However, company U had recognised that it did not have sufficient resources to tackle all those markets it would wish to. The decision of management was therefore to develop a strategy of cautious <u>product</u> sale within those markets where transport costs did not mitigate against the product and to license the <u>process</u> out into those other markets where direct sale was precluded. Licensing within home markets would be considered on the back of product sales. At the time of the case study this process appeared to have been relatively successful in providing a reasonable return from the technology.

COMPANY V

Respondent: Production Manager

Company V[1] is a major subsidiary of a large holding company divisionalised into wholly autonomous units. It was set up in the middle of the nineteenth century to exploit a new process for weaving small runs of personalised nametapes. The company was a family concern until the middle of this century and still has members of the original family on its board of directors. At the time this case study was written, the company employed approximately two hundred people.

Although the company is a market leader in its field, it had, until recently, operated relatively antiquated production processes. Since it was effectively a monopoly supplier in the UK, however, management had not perceived any need to modernise and the company was therefore eventually subject to competition in its market by the introduction of new printing techniques which gave almost as good a result on nametapes as the company's woven product.

The external competition caused the firm to rationalise its production and by the mid 1970s more modern production machinery

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1. Company V was identified through the 'Leverhulme' research reported in Chapter 6.

had been installed. This led to a substantial reduction in the numbers of people employed in the firm. The new technology proved problematical in its operation, however, causing the firm to fall into deficit over a six month period during the introduction of the new technology.

As a result of its production problems the company approached its local University (Aston) for assistance. Through a teaching company scheme the company employed a postgraduate engineer who had skills in electronics, control engineering and computers. This individual, over a period of eighteen months, developed an automated system that improved the productivity of the production system and transformed the manufacturing process. By 1979 the company had established a new computer based system which utilised a British made minicomputer. The success of the system led the company to regain its previous profitability and market dominance. In 1980, a new Managing Director was recruited to manage the growth of the company.

Even before the new automated system had been installed successfully, foreign buyers had approached the company with a view to buying the licensing rights to the process technology. Initial negotiations took place with Japanese, German, French and American companies. Several of the potential licensees sent technical personnel to visit Company V to evaluate the system and all of these expressed further interest in taking a licence. A major problem, however, was the UK minicomputer which had software which was incompatible with other, more readily available computers. This was a major problem in attempting to license the system 'out' since either a UK manufactured computer would have to be supplied with software as a package (and this was not very attractive to potential licensees in view of potential servicing problems) or the software would have to be rewritten for other machines. In view of the lack of management resources at Company V, this option was also somewhat unattractive.

It was apparent that the advantages of following the licensing option were not clear to top management within Company V. Although continuing royalties would flow to the company, much development work would have to be carried out before an exportable system could be completed. Management therefore compromised and proposed that a large (£100,000) 'up-front' fee be paid before the technology would be transferred to any licensee. This fee would cover developmental costs of the system to a 'portable' form while also providing Company V with a large return for its investment in management time and technical resources. The figure of £100,000 was deliberately pitched high to ensure a high return. The Managing Director who was responsible for the pricing decision had recently taken over from his predecessor who had been much more enthusiastic about licensing. However, in practice the size of the 'up-front' fee appeared to be too high for potential licensees and negotiations were eventually broken off. As a result, Company V expended a great deal of management time but failed to benefit from a large number of potential customers.

Low priority was accorded the use of licensing within Company V. All negotiations were delegated by top management to the production manager who had many other tasks to carry out. This individual did not appear to be a strong 'product champion' and was therefore unable to carry negotiations through. Licensing was not pursued as an integral part of company strategy, probably because of inertia at both top and middle management level. As a result, although negotiations were carried out spasmodically with potential licensees over an eighteen month period, no agreement resulted.

In conclusion, top management at Company V perceived, probably correctly, that its 'core' skill was in manufacturing of its prime product, nametapes. It was not structured to provide a service to potential licensees, and it perceived intuitively that utilising technology licensing would be responsible for a diminution in management time devoted to its main business. As part of a strategy of survival, Company V was possibly acting rationally in concentrating on core skills. However, at the time of the potential licensing agreements the company was once more becoming profitable and in retrospect management recognises that a potentially successful 'spin-off' business could have been created.

A positive decision <u>not</u> to utilise licensing in response to resource constraints was not taken however. Rather, pricing policy was effectively used to deter licensees from taking advantage of the technology. It appears therefore that Company V developed its licensing strategy reactively rather than in a positive manner, but that this process was intuitively rather than explicitly developed.

COMPANY W

Respondents: Managing Director and Technical Director

Company W [1] is a relatively small private limited company based in the West Country. The company was set up in the late 1950's and currently employs 140 people with a turnover of £3 million per year. Control of the company is in the hands of four executive shareholder/directors with responsibility for sales, production, technical development and finance. The production and technical functions however, overlap to a certain extent so, effectively, the firm is split into three functional divisions. Another major influence within the company is the merchant bank which provided a majority of the equity finance. This bank however, while providing the company with advice, carries no executive responsibility although one of its representatives sits on the Board of Directors. The company's products are enclosures (cabinets) for housing equipment, and are used mainly in the electronics and computing field for computers, telephone exchanges, etc. While the technology is basically metal manipulation there is a large degree of skill involved in producing a high quality product at a price which is acceptable to the customer. The company drafts and registers its own industrial designs. Many of its products are, however,based on customer specifications and, in these cases, the intellectual property usually remains the property of the customer. Company is very production orientated in that its skills and facilities shape the range of products which

(1) Company W was identified through the 'Leverhulme' research reported in chapter 6.

it makes and sells. The bulk (90%) of turnover is provided by products made on a 'one-off' basis usually to the specific design of a client company. The remaining 10% of turnover comprises standard products manufactured from standard components and frequently incorporated into customers' own equipment rather than sold as stand alone units. By the nature of the business, protection of products through patenting is not really relevant, although registered design portfolio remains an important and growing part of the company's operations.

Patenting has only been considered in the past when long run, standard or innovative products have been considered. The Managing Director stated that outward licensing had also been considered on several occasions since the company's inception. Transport costs of typical products tend to be high and licensing has seemed a potentially logical method of extending the business. Since the skill level within the company is high even though the technology itself is relatively simple however, the technology has proved to be somewhat difficult to transfer.

Outward licensing has been used in one specific instance. The product involved was a metal computer cabinet. Company W received an enquiry from a large European company which wished to manufacture the product in some volume to fulfil orders in the European market. Company W's response to this enquiry was to agree to sell the technology and to draw up a license agreement in conjunction with a local solicitor. On submission to the European company however, it was agreed by both sides that the agreement as drafted was unsatisfactory. As a result of this the licensee company suggested that one of its own simple standard agreements should form the basis of the contract. The change in agreement caused a delay of three months in signing the agreement. The agreement was divided into three parts, namely, production, sales and technological exchange contracts. The agreement has until recently progressed reasonably satisfactorily from company W's point of view, providing a continuous though modest flow of royalties to the company. Company W has provided technical assistance as consultancy in response to the licensee's changes of design and other requirements. However it appears that the licensee company now poses something of a threat to company W's existing markets. These markets are 90% UK based with exports accounting for only a small proportion.

Royalties appear to have been a major contribution to company profit over the past 10 years in view of relatively low profits on subcontracted work. However, though the agreement appears to have been successful, company W has not attempted to license either the first or other products proactively in other foreign markets. Licensing does not appear to be a mainstream feature of the business. Management consider that because of the relatively simple technology and high skill levels involved in the production of the products, licensing is never likely to account for more than a small proportion of total turnover.

In conclusion, it appears that company W has treated licensing in a very opportunistic manner. The company, in a non technically progressive industry, appears to be content to develop its sub-contracting business rather than develop a range of 'own brand' products. Where it was approached to license its existing products 'out', management was prepared to do so, but it appeared not to have developed a strategy to build upon the success of the initial agreement. It seems clear that technology licensing comprises only a peripheral activity for company W, although the Managing Director of the company did recognise that licensing could be a method for developing his business.

COMPANY X

Respondents: Managing Director and Marketing Director

Company X is a small (42 employees) privately owned manufacturing company in the Glass Reinforced Plastics (GRP) industry. The company was set up in the early 1970s to manufacture and supply standard, small, GRP products, by an ex-manager of a large firm making GRP sheeting. Following first year losses the firm rapidly moved into profit and expanded quickly over the following five years. It began to build an expertise in particular types of GRP technology and this led to approaches from foreign firms wishing to buy its technology. Following these approaches Company X decided in 1976 to set up a subsidiary company (LPD) to carry on research and development work under contract, to develop new products 'in-house' and to handle any requests for the sale of technology. One major purpose of setting up LDP was to give two newly recruited directors the possiblilty of taking an equity stake in the company.

LPD has only 12 employees (4 directors and 8 others) but is probably the most valuable part of the firm. It has evolved a strategy for the development and sale of technology <u>per se</u> in preference to developmental work for future manufacturing turnover, accounting for 30% of company X's total. In order to fulfil its research objectives the company recruited in 1978 a highly qualified engineer who has played a central role in the design of machinery required to make laminated GRP products on a mass production basis. This is important, since the essence of LPD's know-how agreements involve either the sale of machines or the sale of drawings and expertise for building machines. It may also be important to note that the pursuit of profit through high technology, capital intensive development work, has allowed the company to expand without taking on a large labour force and greatly increased managerial control over its technology while also increasing turnover. The Managing Director claimed that one of the main reasons for selling technology under licence was that the company could not obtain the capital to expand its manufacturing capacity and with its existing salesforce and production labour force it did not have adequate capacity to serve its market. Potentially lucrative contracts were being turned down because of this problem. However, another reason for selling technology was stated to be a desire for the company to remain at a small and manageable size.

In 1978 the company felt the need to diversify out of existing products, and investigated the problems posed by the Post Office (PO) of developing a lightweight glass fibre reinforced telegraph pole as a possible form of product and market diversification. A process to 'spin' GRP was developed. The process could not be patented however, since a similar process had been patented in the iron casting industry in 1941. Much of the company's R & D effort was directed towards this product and between 1978 and 1980 R & D expenditure increased approximately 500% from £20,000 to £100,000 per annum.

The technology of spinning a GRP tapered pole was something several larger companies had already attempted, unsuccessfully. On the basis of its prototypes the PO offered a development contract to LPD whereby both parties provided half the development capital for a production line. The company proceeded to develop a machine for mass production and now produces the poles 'in-house' in small numbers (up to 10,000 per annum). LPD does not wish to go into large scale production however. The total market for the poles in the UK and abroad is enormous but in the UK the PO insists on multiple (four companies) sourcing and in view of this competition LPD decided to exploit its process under licence. In any case, transport costs of the product preclude direct exporting except to markets very near to the UK (i.e. in Europe). Thus licensing is probably the only realistic strategy for exploiting the company's technology in worldwide markets.

As part of the agreement to provide development funding the PO required a 1.25% royalty on any sales to licensees. LPD was able to retain lump sum payments from licensees, however. LPD state that they are often involved in setting up turnkey operations - particularly in under-developed countries - as well as direct licensing. This method of market development however, is something the company would prefer to reduce because of the high manpower commitment on their part in setting up such agreements. Since their technical manpower resources are small this had led to resource problems in the past.

LPD have built up a good reputation and have not usually had to seek out licensees. Rather their problem has been too many potential customers and enquiries for them to handle adequately in view of the resource constraints mentioned above. Their use of professional advice has been limited to legal advice and the use of a patent agent.

LPD's marketing strategy is to sell technology as part of a broad package of drawings, machines, know-how and production techniques. With their sheeting products (which are relatively low technology, but high production skills) the company found sale of a broad technology package a viable strategy in producing a reasonable return while conserving scarce management resources. Much of their machine components, and all raw materials, are bought in from outside suppliers. This, together with an overall policy of selling technology rather than products has enabled the company steadily to increase its turnover and profitability while remaining small and manageable. However, Company X has encountered some cash flow problems in its licensing strategy. Although many firms wished to license the technology, only a small proportion of initial contacts led to agreements to sell the technology. Even where agreements were reached, the mean time between initial contact and agreement was seven months. Company X had invested substantial resources in the acquisition of a long term return.

In conclusion, Company X recognised at an early stage that it had a choice between entering a mass production market with its new technology or selling that technology. The philosophy of the directors was that mass production with its consequent requirement for increases in the numbers of personnel employed and an increase in the resources required was likely to prove less attractive than development through the sale of technology.

The company developed an attractive package for sale to potential licensees in which training and back-up support was provided. However, this strategy had led to a greater demand upon the company's resources than had first been envisaged. Eventually, Company X compromised and carried out both licensing and production of goods. This appears to have been a successful strategy for the company to follow.

Company X has utilised licensing proactively from an early stage in the success of its major product. In this is has built on a particular past success. It was this success that catalysed the use of licensing. Before this however, Company X had not considered licensing as a strategy. To some extent therefore its use of licensing has been in an opportunistic manner.

APPENDIX 6.3

INWARD/OUTWARD LICENSING CASES

COMPANY AA

Respondent: Managing Director

Company AA[1] is an old established (1760) West Midlands spring manufacturing company.[2] Until 1978 the company remained in family hands, but was then taken over by the Staveley group of companies. As a result of the takeover the company was broken up, with non-spring subsidiary companies falling under the management of another Staveley division. Currently, Company AA employs 370 people in three divisions: (a) High volume springs for the car and other industries, (10,000 item orders as a minimum); (b) High volume pressings, mainly for the electronic industry, including circlips and other stampings, (50,000 item orders as a minimum); and (c) Low volume springs and pressings. The last division might be considered the 'high technology' part of the company since it is here that specialist applications are developed for customers. The technological advances made here can be utilised in other divisions. The company's products are defined as 'cold' springs, i.e. they are mainly made from wire coil rather than from forgings. Effectively this means that Company AA operates in generally smaller precision spring market segments rather than in the very heavy segments, (e.g. truck leaf springs).

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1. Company AA was identified as a result of consultancy work carried out for West Midlands Council in 1985.

2. Claimed to be the oldest in the world.

The Managing Director of Company AA suggested that the company had become market leader through its ability to offer customers a complete spring design and manufacture capability for particular applications. Most other UK spring producers merely manufactured springs from customers' own designs. The company also uses only very high quality primary materials. Company AA has found increasing difficulty however, in UK sourcing of high quality wire used in spring production. A large proportion of the tempered wire it uses now comes from Japan and Sweden, although for less demanding applications it still has two major UK suppliers.

The company has utilised outside sources of expertise on an extensive and proactive basis over the last thirty years in its strategy to maintain market leadership within its market segments. This has involved it in the use of contract and collaborative research, the use of design consultants, university engineering departments and inward and outward licensing agreements. One of its main product lines, circlips, currently accounting for nearly twenty per cent of turnover, is based on an inward licensing agreement set up in the early 1950s.

The company had identified the (then) new technology of circlip springs in the American market and approached the US market leader to seek an agreement to collaborate to exploit the UK market in which there was then no British supplier. Initially, the agreement took the form of an agency with the American company providing supplies of its product for sale in the UK. However, sales volume quickly rose and Company AA then set up production in the UK.

Under the licence agreement a two per cent royalty was payable on sales. The licence agreement provided the basis for an important new activity for Company AA and it has developed the technology involved using its own R & D facilities. Although there has been some 'grant back' of developments, the American company is now technologically inferior to Company AA and is not therefore a source of further licences. A further disadvantage of the licence agreement, has been a clause preventing export of circlips to the United States market by Company AA. The company, as part of its growth strategy, now wishes to enter this market, but to do so it will have to break clauses of the licence agreement. Company AA hopes this can be done through mutual agreement with its licensor. It is clear, however, that the American licensor has, in this case, set up a competitor which is now threatening its own markets.

While inward licensing has been successful for Company AA, the company has also developed strategies for utilising outward licensing. This has mainly involved the licensing of process technology and the company has a Swedish licensee for one major process. However, although Company AA considers that its technology is more advanced than competitors', it has not been very successful in its endeavours to out-license this technology to others, particularly in the United States. The Managing Director suggested that this may be because of the NIH (Not Invested Here) syndrome in many cases, but also because of Company AA's concentration on quality of production, rather than speed *per se*. He suggests that although his processes may not be the fastest (in number of press operations per minute) on the market in terms of usable springs per time period, they out-perform other technologies. However, the strategy to out-license this process technology cannot be claimed to have been a success, even though Company AA has proactively tried to sell the technology.

Currently, Company AA is considering the use of outward licensing for another piece of technology. This comprises an innovative door hardware mechanism and arose as a 'spin-off' of R & D work that was being carried out for another product. The company developed the idea to prototype form but recognised first that it did not have the skill to develop the product for volume manufacture, second that the product would not fit with current product lines and third that it did not know the best way to market it. The company therefore developed a strategy to collaborate with others to exploit the product. It engaged an industrial design consultant to re-design the product for volume production and it commissioned Cranfield Business School to develop a marketing plan for selling the product. Following the reports of these consultants, Company AA recognised that the product could not easily be produced and marketed 'in-house'. It therefore decided to offer the product as a 'package' for joint exploitation with a licensee. It is the company's objective to utilise its own skills in stamping out parts of the product while licensing the assembly and marketing to others. It is currently carrying out negotiations with two potential licensees in the UK which it approached to sell the technology. The company's preferred strategy is to license the package to a local licensee and grant 'world rights' to this licensee.

In conclusion, Company AA has used 'technology transfer' in several ways and as an integral part of its strategy for developing and exploiting new products and markets. Its status as market leader has been of assistance in this process, both in utilising outside expertise and in inward and outward licensing. High expenditures of R & D have supported its technology leader position. It appears to have utilised technology licensing proactively, but only as one strand of its technology policy, and in support of other techniques for product and market development.

COMPANY BA

Respondent: Managing Director

Company BA[1] is presently owned by a consortium of large companies, financial institutions and private investors. The company's origins as an independent concern date to the late 1950s when the company founders discovered and patented a new process for the utilisation of vinyl and textiles for the production of specialist printed PVC sheeting and coated fabrics. This product laid a foundation for the company's success and it built up strengths in designing particular chemical formulations for its customers in the plastics products industry. These strengths were enhanced by the company's research and development department, which concentrated on 'development' rather than 'research' for customers. Much of the company's turnover during the period was attributable to 'contract R & D'.

From small beginnings the company grew quickly, having to change its premises three times over a period of twelve years. In the late 1960s, the technical and production facilities which had previously occupied separate sites were brought together, with a consequent increase in empathy and efficiency. Following a period of sustained and increasing profitability, the owners of the company sold out to a large conglomerate group in the early

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1. Company BA was identified through the 'Leverhulme' research reported in Chapter 6.

1970s. Seven years later the conglomerate sold a majority of its shareholding in the company to a disparate group of investors who comprise the present owners. The company at the time of this case study employed approximately four hundred people and had a turnover of about twenty five million pounds per annum. It therefore lies at the top end of the range of 'smaller' concerns. Although Company BA is profitable, increases in feedstock prices and world recession halted its previous high growth profile in the early 1980s. Currently, it operates in two major market segments of the PVC resin compounds supply industry. It ranks among the top three companies of that industry by market share.

Company BA has utilised licensing in a highly proactive manner, both in buying and selling technology. In part this reflects the culture of the industry, where technology licensing appears to be accepted as a normal method of business practice. The company has utilised licensing 'in' where it required particular technologies that would have taken too long or cost too much to develop 'in-house'. It has utilised licensing 'out' mainly to overcome tariff barriers or other restrictions.

The company currently has two major 'inward' licences, which lie at the heart of its manufacturing businesses. The first licence was purchased from one of the major oil companies that had developed, in its own laboratories, and patented a process for the utilisation of part refined oil feedstocks into polyvinyl chloride (PVC). The process was an important advance in the production of PVC, but was not of direct utility to the patentees since it was not part of their mainstream activity to produce derivate oil based products per se. They were more interested in developing new uses for their main product (i.e. oil feedstocks). The Managing Director of Company BA states that a process of development by the oil majors of new users for their primary products is a feature of the oil industry. The process, which was acquired under a non-exclusive licence, gave Company BA an important advantage in its export markets, although in its home markets both its major competitors had also licensed the process. The licence has proved to be extremely profitable.

The second inward licence accounted for a smaller amount of turnover. This was an exclusive licence to produce a speciality chemical polymer product, for which there was a large demand but no supplier in the UK. Company BA acquired the licence rights for the product from an American company which was not operating in the UK and quickly became the main supplier in this market. The licence has proved profitable for both the licensor and licensee companies, although it accounts for less than five per cent of Company BAs sales.

Outward licensing has been used by the company on more than fifty occasions, mainly to third world countries. In almost all cases, the company has utilised licensing to overcome tariff barriers or in response to the geographical separation of its production facilities and its markets. The latter factor is particularly important in its mainstream activities, production of PVC sheet, and resins where costs of transport to distant markets would have prohibited market exploitation by export, in view of the relatively low profit margins of the products. The company has developed its licensing procedures so that it now has a 'standard package' and full time personnel employed upon the sale of technology rather than goods. Usually the terms of the licence agreement oblige Company BA to design and install equipment in the licensee's factory. Training of personnel in the use of the technology is also carried out and supply of initial batches of raw materials, and in some cases products, to allow the licensee to enter his local market at the earliest possible time is also undertaken. Licensing activities have been a successful part of company operations, and these presently employ a staff of approximately twelve people, with the part-time participation of other engineers and technicians who are seconded from the manufacturing operation as required. Profits from the licensing operations, which have been substantial, have been ploughed back into further R & D work on the applications of materials, in which the company appears to have a competitive advantage. Licensing accounts for a large and growing part of the company's activities.

In conclusion it appears that Company BA has utilised licensing as an integral part of its marketing and new product development strategy over a period of years. Licensing is recognised as an important method of obtaining new process technology from other, larger companies, which may find the markets of Company BA too small to be worth entering. Company BA has therefore been able to obtain a degree of market leadership in its own market segments partly by the utilisation of inward licensed technology. At the same time, it has enhanced the value of purchased technology by committing substantial resources to Research and Development. This has allowed it to accept new technologies and improve upon them. As a result of its R & D strengths it has been able to license its own technology out in a highly proactive manner, and obtain a high return on licensing operations. These resources have generally been ploughed back into R & D thus increasing Company BA's competitive ability and leading to large increases in turnover and its current status of market leader.

COMPANY CA

Respondents; Marketing Director and Technical Manager

Company CA(1) was set up in the early 1960s as a subsidiary company of a large group, initially to market, then manufacture, telephone answering machines. It currently employs 150 people. The company developed its technology and became a major supplier of equipment, mainly to the Public Telephone Utilities. Its main customer was the (then) UK Post Office, but it also carried out a small amount of exporting. Following a decade of expansion and technological development, the company entered the 1970s in a relatively strong position. At this time it also entered into an agreement with a major UK telecommunications manufacturer to collaborate through a joint venture in the production of a new range of equipment. In 1972, the company was sold to another UK conglomerate firm, not at that time involved in the telecommunications industry. This led to some loss of direction for the company, which remained profitable however, mainly as a result of its position as a semi-monopoly supplier of particular items of equipment to the Post Office.

In the late 1970s numbers of new, competitive products based on micro-processors technology were introduced to the UK by several

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(1) Company CA was identified through the Leverhulme research reported in Chapter 6.

Japanese companies, and the pace of technological change increased. In view of its large market share in the UK however, the company was slow to develop its own technology to meet this threat. At the beginning of the 1980s, the company was the subject of a management buy-out, largely funded by city institutions. This move coincided with 'deregulation' in the UK telephone industry. The firm lost its semi-monopoly position as supplier to the Post Office. However, the company saw deregulation as an opportunity for it to expand, rather than a threat, since technological developments were reducing manufacturing costs and bringing prices down, thus increasing the size of the market. However, the company soon found its markets under increasing threat from cheap imported and technically superior products from the Far East.

The company has historically utilised inward technology licensing for acquiring new products and outward licensing for developing its markets. Licensing is usually considered in its new product and market policies as a potential alternative to the use of 'in-house' development and as an alternative to exporting, in markets closed to it by tariff barriers or for other reasons.

The company's first experience of licensing was in 1973, in the purchase of technology designed to improve the quality of its telephone answering machines. The technology was purchased from a UK company that had been considering entering the market. This company was however, taken over by another group before it launched its product. The new owners of the licensor company decided to divest their telephone answering machine technology and exit the market. Although the technology in question was still in prototype form, it did have certain advantages over Company CA's technology and therefore was useful to it. The technology was further developed by Company CA utilising its research and development strengths (at this time it had an R & D complement of approximately twelve qualified scientists and engineers). After development, the product was launched and proved to be successful.

Inward licensing had proved useful in this case to Company CA not only in filling a gap in its product line, but also in increasing turnover of the company, thus using under-utilised space and other manufacturing resources. The company recognised this over capacity as a major problem. Technical advances were reducing their space and personnel requirements. Instead of divesting these resources however, the company sought and was initially successful, in utilising them by developing new products, through licensing and 'in-house' development.

Company CA had also utilised outward licensing and in a more intensive manner than inward licensing. Usually, however, this was in response to the company's inability to export its products to certain (particularly continental European) markets. This resulted from protectionism by local telephone authorities who stipulated (as in the UK at that time) that only national manufacturers could supply their Post Offices requirements for answering machines. To this extent, Company CA was forced to develop export markets through the use of licensing agreements.

However, export income never accounted for more than ten per cent of total turnover and was effectively a fairly peripheral activity for the company. In addition, under its outward licensing agreements, Company CA provided not only designs, but technical and marketing back-up to its licensees. This was a drain on the resources of the company and the Marketing Director suggested that clauses in the agreements on support facilities for licensees, were probably not drawn up strictly enough.

However, the current case relates more to Company CAs search for inward licensed technology to overcome the 'Japanese threat' of the early 1980s. After deregulation, a 'flood' of cheap, technologically advanced, Far Eastern, products were imported into the UK market. Company CA began to incur heavy losses as its market share shrank. Management considered importing and marketing answering machines, but decided to endeavour to continue to develop its own technology through inward licensing agreements on top of its own 'in-house' expertise. Company executives visited Japan and the United States to seek technology to import. However, at the time of this case study, although negotiations had been commenced with several potential licensors, no agreement had resulted even though the licence search had commenced six months before.

The reasons for the failure to identify a suitable licensor were not clear to management in view of the effort that the company had invested in searching for such licensors. Different problems had caused the breakdown of discussions with different potential licensors. In one instance the royalty rates that the licensor was seeking seemed too high to the company. In another, local sourcing of particular components could have been a problem. A third problem comprised Company CAs requirement that imported technology should 'fit' with its own existing skills. The company had been surprised by the collapse in its markets and did not appear to have developed a strategy that would provide new technology quickly enough.

In conclusion, although Company CA had substantial 'in-house' expertise in the area of technology licensing, it seemed to have been unable to utilise this expertise effectively in overcoming the technology crisis resulting from 'deregulation'. Morale in the company seemed low in view of the company's increasing losses and it was clear that numbers of key personnel had left the organisation. Development of a forceful strategy to obtain new technology quickly, seemed an urgent priority.

COMPANY DA

Respondent: Managing Director

Company DA[1] is an old established family owned company in the toy industry. The company was set up in the last years of the nineteenth century on the basis of an invention for a child's modelling material. This patented invention, for which there was then no competitive product, provided the company with a monopoly position which it exploited successfully over the life of the patent. For a period of more than fifty years, the company was profitable on the basis of its one product, but by the late 1960s as a result of falling turnover, management recognised that it was necessary to diversify into new products. This decision appears to have been forced on an unwilling company, first by the increase in competition, particularly from foreign products, which steadily increased their market share at Company BAs expense. The second major reason for the decline was a change in the type of product that comprised a majority of the toy market. Electronic based products began to be increasingly important. Allied to this an increase in the number of houses that were carpeted led to the product being less popular with parents because of the dangers of damage to those carpets.

The company diversified, initially by the purchase of two other companies, in complementary market segments of the toy industry.

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1. Company DA was identified through the 'Leverhulme' research reported in Chapter 6.

However, the marketing skills of Company DA proved to be inadequate in an industry that was becoming increasingly competitive as imports, particularly from the Far East, took a larger share of the market. In the mid-1970s therefore, after a period of falling sales and mounting losses, the family sold their holdings to a toy company group which mainly bought the company for its trademarks and reputation. The company currently employs approximately one hundred and fifty people with a turnover of £3 million per annum, and is run by professional managers appointed at Group level.

Licensing was stated by the respondent to be an integral part of the toy industry. He suggested that there were probably several reasons for this. First product life cycles are very short, hence the time that a firm has to exploit any particular product may also be restricted. Second, the industry is heavily segmented into small market areas. Companies know the other companies in their market segment through the annual toy fairs and hence are aware of what may be available under licence. Third, the technology is relatively easy to transfer, being 'design' based and simple. Lastly, designs and characters are generally more easy to register and protect than is the case with the patents involved in more complex technologies. All these factors are stated to have led to licensing becoming an integral part of the industry.

In the case of Company DA, use is made of both inward and outward licensing. The company has a policy of both seeking new innovative products from foreign sources and also of licensing its own innovative products out. This policy has led to approximately fifty per cent of the company's turnover accounted for by licensed products. Toy trade fairs provide a major source for Company DA to seek potential products for inward licensing. These annual events are attended by most of the senior executives of industry companies. Company DA considers that it has a lot to offer potential licensors, particularly the skills of its marketing team. This team is able to generate large volume turnover on new products very quickly. Most licence agreements are signed in principle during meetings at the toy fairs, over a period of days. Licensing is, therefore, a very quick process, facilitated by the presence of senior executives from many companies.

Company DA also has a relatively large 'Research and Development' department although most personnel in this department are employed on product design and development rather than any basic research. The success of this department has been demonstrated by the launch of a number of profitable new products over the past four years. Since industry product life cycles are so short, it is necessary for the company to innovate continually.

For successful new products the company has no need to seek potential licensees. These approach the company to request licences. For less successful products, the company makes no attempt to 'sell' the product under licence. The Managing Director considers that this policy would be counter-productive.

Few companies are likely to want to license a product that has not been very successful in its own home market. To an extent, therefore, Company DA is reactive in its use of outward licensing, awaiting approach from licensees, but proactive in its inward licensing policies. This probably typifies the use of technology licensing in the industry, with licensees seeking potential licensors.

In conclusion, licensing is clearly a major part of Company DA's strategy, complementing its own in-house and marketing skills. Company DA has utilised licensing in a somewhat more proactive way than many other case study companies. This may reflect the particular instance of the toy industry, where the technology licensed is of a low level. As an integral part of company policy, licensing has clearly played an important part in the recent growth of the companys' turnover. There does not appear to be a realistic alternative to the use of inward licensing for the company, since the company's own 'in-house' facilities would be unlikely to be able to produce many products as successful as those that are licensed 'in'. Outward licensing is similarly necessary because of the short product life cycles in the industry and the company's small marketing resources.

COMPANY EA

Respondent - Technical Director

Company EA[1] was set up as a family concern in 1960 to supply equipment to public utilities engaged in construction work. Initially the company acted as an agent in supplying imported products, particularly specialist equipment for testing and other engineering applications. For the first six to seven years of its life the company concentrated on developing its marketing strengths. During this period both turnover and profits of the company increased. In the late 1960s the company, in response to an approach by the UK Gas Board, designed and developed a piece of equipment for tracing metal pipes underground. The objective of the equipment was to enable Gas Board engineers to identify the correct place to excavate, in repairing broken gas pipes. The company had been asked to develop the product under contract in response to its known skills and the small R & D department which it had set up, initially to service and customise equipment from its foreign suppliers. The new product proved successful, and following a change in policy the company commenced manufacture of the unit, initially on a sub-contract/fabricate basis, but eventually producing and assembling most components 'in-house'. Following this change of direction the company began to specialise in developing and manufacturing equipment for similar applications. The current philosophy of the firm was summed up by the Technical Director as producing products to cover all activities associated with 'digging holes'. At present the company employs about 120 people with a turnover of £3 million per annum.

As part of its search for new product lines, the company had established links with the Ministry of Defence. (MOD). This link was initially formed when Company EA became a supplier of equipment to the armed forces. Following MOD development to prototype form of equipment for detecting poison gas in the atmosphere, the company approached the MOD to request access to the technology for non-military and commercial uses. The company saw a market for the product within the public utilities particularly the Water and Gas Boards. The MOD were unable to grant an exclusive licence to Company EA due to public policy restrictions, and in response to this, a joint venture company was set up between Company EA, the MOD and another private company. The latter firm was not, at that time, in competition with Company EA so an agreement of this form was acceptable to the company. Under the agreement further necessary R & D work was carried out utilising Company EA's technical expertise but with financial and some further technical support from the other company.

Following development of the technology, and under the agreement, a new remote reading gas detector was developed. This was manufactured under the terms of the joint venture by the partner company. Company EA acted as the marketing arm of the venture since it had at that time no suitable manufacturing facilities. Profits were divided between the two companies. The licence agreement has been a qualified success for the joint venture partners despite somewhat onerous clauses on the ownership of any further developments of the technology by the licensor. As a licensor, the MOD has not been particularly helpful in providing back up R & D and other support facilities. However, it has proved to be a large customer for the product, which is now also being exported. The product has proved a useful, though not spectacular, revenue earner for the company.

Company EA has developed its R & D capabilities such that it has produced a number of developments that are not of immediate or direct applicability in the company's own markets. The unsophisticated nature of the technology involved has usually meant that these developments can be relatively easily patented or design protected as applications and enhancements of existing technology rather than fundamental developments. Following the development of a security product for the building industry which it did not wish to manufacture, Company EA decided to license this product out to another firm in the UK. At the time of writing the agreement is still in its infancy and the success of the licence cannot be gauged. However, the technical director regarded this licence as very much a peripheral activity, and was not anticipating receiving a large income from it. This may be due in part to the simple type of technology involved and the small amount of resources that the company had expended upon developing it.

In conclusion, Company EA has not embraced licensing as a major part of its product/market strategy. However, it is clear that the company has benefited to an extent from inward licensing, particularly in the change from a marketing to a manufacturing/marketing business. This change of emphasis is still at an early stage, however, and the Technical Director of the company believes that technology licensing is likely to play an increasing role in the development of the company. The current strategy of the firm is to identify new products for marketing and manufacture from any source that may be available. Consequently licensing searches have been instituted as one part of the new product development process. Company management now appears intent on increasing turnover and developing a strategy of growth. In this process licensing may have an important part to play.

COMPANY FA

Respondent: Managing Director

Company FA[1] was set up in the early 1920s as a small private company manufacturing unwelded and furnace welded steel tubing. The company operated a small strip rolling mill for production of steel for its tubes. At that time the company's main customers were electricity utilities who used the tubing in conduits. Company FA specialised in supplying black painted tube for this purpose. Following the 1939/45 war, the company was acquired by a steel processing group which was able to inject substantial resources into the company allowing it to modernise its plant and develop new technology for the production of precision tubes.

Following an increase in demand for specialty, coated, rust resistant, steel products (non tubes) the company entered this market segment in the early 1960s and gradually increased its market share. It became market leader in the field in the early 1970s and presently dominates the market for coated pröducts. At the time of this case study the company employed six hundred people and can be described as a medium sized engineering company.

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1. Company FA was identified through the 'Leverhùlme' research reported in Chapter 6.

The initial use of licensing in the company occurred in the late 1960s when the chairman of the company, on a visit to the United States, came into contact with an American company which had just developed a new technology for the production of galvanized tubing on a 'production line' basis. Although the technology was not completely developed, it did appear to have important advantages over any of the competitive processes on the market. Since the cost of transporting steel tubing is high, exporting is usually uneconomic. The US company was therefore willing to grant a licence to Company FA on the basis that further development would be jointly funded by and be the joint property of the two companies. On this basis, Company FA obtained an exclusive licence for the UK market and non-exclusive coverage for other continental European countries.

Following its first licence agreement, the market for the galvanized tube both in industrial applications and as a semi-decorative product continued to expand. This led to a new satellite plant being set up to produce the product. (All production had previously been concentrated at its main site in Birmingham). The licence gave Company FA a competitive advantage in that a premium price could be charged for the higher specification product. The profits that accrued to the company were ploughed back into R & D on further coated steel products. As a result of this strategy, a 'family' of products was developed. Following these developments and in-depth market studies, the company decided to endeavour to develop a product based on a plastic rather than a metal coating. This diversification away from its 'core' skills led to a further collaborative research programme between Company FA and its original licensor. This programme, carried out almost wholly in the UK but also utilising American technology, expertise and finance, led to the development of a durable, plastic coating process. This process was patented world wide and following exploitation, led to a large increase in the company's turnover. Company FA, as part of the agreement, obtained exclusive world marketing rights.

The new process further enhanced the reputation and increased the profitability of Company FA. Following approaches from a German and a French company, Company FA licensed its technology 'out' on the basis of further R & D collaboration. Once again, Company FA considered that the partners in this venture were unlikely ever to become competitors because of transport costs on the finished product. Further licences for the process were granted to companies in other markets throughout the world. Company FA has found little difficulty in identifying potential licensees both because of the relatively small numbers of companies operating in the field, and also because of the innovative nature of its technology. The income accruing from these agreements has been used by Company FA to increase its research and development efforts to retain, and improve upon, its competitive position in the UK and internationally.

In conclusion, Company FA appears to have used technology licensing in a 'textbook' manner. Its initial inward licence increased its technological base and the new process generated a large and continuing income that has been used by the company to develop new and improved processes. Following this expenditure on R & D, the company was able to enhance its competitive position vis à vis other companies in the field, and was able to develop new products quickly enough to retain this position. Its outward licences have, once again, provided funding for developments integral to the production of products for its own home markets. While other collaborative, non-licensing agreements, such as joint ventures and inward investment have been considered by the company, only the former have been used (in two cases) as an alternative to licensing. By this means the company has been able to remain highly profitably innovative and a world leader in its technology.

COMPANY GA

Respondent: Marketing Director

Company GA [1] is an old established company, set up in the late 1920s to produce fire safety appliances. Initially the firm developed skills in metalworking and fabricating and in applying specialist finishes to metal. It also built up expertise in manufacturing chemical propulsants, designed and used in its range of fire extinguishers. Currently, the company is part of a medium sized chemical products group which took over the firm in the 1960s. Company GA no longer produces fire appliances but has retained many of the skills and technologies that were used in that market. Its present major activities encompass technology in metal finishing and paint bonding treatments. The company specialises in the use of phosphate cleaners to remove grease and other unwanted matter from the surface of metal components. These can then be treated with rust-proofing and other compounds designed to protect the metal surfaces from atmospheric or liquid attack. The company's main markets lie in the food processing plant and automotive industries. The company is able to provide a complete plant for cleaning, degreasing and treating components. At present the company employs about one hundred and fifty people.

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1. Company GA was identified through the 'Leverhulme' research reported in Chapter 6.

In the early 1970s the company sought to develop its range of protective products. Although its current product lines provided a reasonable turnover and profit, it was seeking to expand its operation. Through industry publicity sources it became aware of several developments in the United States in the field of rustproofing and in 1972 licensed a new process 'in' from a United States company. The process, though compatible with already available technology within the company, was fundamentally different from it, being based on a two stage chemical rust-proofing process for iron and steel. This was diversification 'downstream' from its current product lines, and hence provided a good marketing 'fit' for the company. The process involved the application by immersion of suitably cleaned and de-rusted components in a chemical bath. The major attraction of the licence was in obtaining access to the speciality chemicals involved in the process. The process was a direct competitor to other protective processes such as galvanizing and provided a highly corrosion resistant surface superior to other treatments. The process does have a major limitation in that it can only be used for components that can be immersed. The chemicals cannot be painted on to surfaces. However, even large steel assemblies can be processed through being broken down into smaller sub-sections. Around this process and the chemicals involved, the company has designed a family of process equipment comprising immersion tanks and/or rotary barrel units, which it installs on a contract basis within the UK and overseas. Over a five year period from 1972 it provided total UK coverage for the process through the use of sub-contractors.

The main advantage to the company of the licence was that it opened up a new market (for the treatment of small components) while at the same time providing direct competition to other, older processes (such as galvanising). The licence has been very successful in enhancing the range of processes the company can offer. Approximately thirty per cent of Company GA's turnover is now accounted for by the licensed process and derivations of it.

The licence agreement with the US firm gave Company GA the rights to exploit the process in all markets except the United States, Canada and South America. The company has therefore actively sought to sell its expertise in foreign markets. In view of its relatively small size, Company GA developed a strategy of promoting joint ventures where the company provides the technology, plant and 'know-how' and a local company provides the factory accommodation and (usually) the finance to set up a treatment plant. In view of the transport costs involved in moving components, it is usually cheaper to set up a treatment plant locally, rather than move components to it. Company GA has therefore been able to segment its market geographically with each joint venture partner being granted an exclusive licence to use the process within his own territory. Where a joint venture has been considered unattractive due to the small size of the potential market or through local laws preventing such collaboration, Company GA has also entered into other forms of licensing agreements with local licensees. Under these agreements, Company GA provides the special chemicals to its licensee as well as supplying the plant and equipment for operations in their local markets, but does not take any equity participation in the licensee.

In conclusion, Company GA has utilised licensing in a proactive manner. Its initial inward licence gave it access to technology which it further developed such that it was able to utilise the same technology in outward licensing agreements. The licensed technology now forms a central part of its business. Company GA has retained control over its technology and exploits its markets mainly through sales of its speciality chemical products. The supply of these products have become a mainstream activity, with supply of process equipment to support this process.

COMPANY HA

Respondent - Marketing Manager

Company HA[1] is a medium sized engineering company in the fasteners business. Most of the products of the company are for high technology markets where reliability is stated to count for more than the cost of the fastener, which is usually a minor component in cost terms in most applications. The company is a subsidiary of a large engineering conglomerate which has recently used the company to 'cream off' profits to be used elsewhere in the group. The Group Management refused to allow profits to be directed to the development of new products within Company HA. Local management became concerned at the long term loss of competitiveness consequent upon this policy. At the time of the case the company employed more than five hundred people at its main site in Hertfordshire.

There was a long standing 'culture' of licensing within Company HA and most senior executives had utilised or had been involved with a previous project that had utilised inward licensing. This first venture in the licensing field had occurred some years before the

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1. An amended version of this case appeared in Lowe J and Crawford N K. 'Innovation and Technology Transfer for the Growing Firm' Pergamon Press 1984. The case was identified through the Leverhulme research reported in Chapter 6.

case and had not been particularly successful. The product was licensed from a US company. However it presented problems both at the manufacturing and marketing stages. At manufacturing there were considerable initial problems in obtaining the right wire for making the product and even now the company is dependent on a single supplier. The material is also very expensive since it is difficult to fabricate. However, the marketing problems were worse. The product had many varied uses in the US but whilst similar industries and markets existed in the UK, local manufacturers seemed averse to using the product in their own products. This inertia by potential customers has meant that the product has had to be modified, but even with these modifications has not proved to be very successful.

In spite of a relatively poor result from the inward licensing venture, the company persevered in its use of the technique. It appeared that this was due in major part to the junior executive who had been given the task of handling all licensing matters for the company. This individual reported directly to the Managing Director and therefore was able to exert a degree of control over the strategic development of licensing within the company. This pressure led to the company becoming involved in two outward licensing negotiations.

The first of these was an agreement with a Russian manufacturer. In this market, Company HA was unable to sell its products through export. In addition, it felt that Russian licensees were unlikely to become competitors in third markets and hence it felt more willing to license its technology. The technology involved comprised process equipment and 'know-how' for the production of high precision alloy fasteners, and although Company HA was not aware precisely what the products were to be used for, it seems likely that there were military as well as civil applications for the technology.

The agreements with the USSR while fairly comprehensive were simplified to some extent in that the amount of product to be produced by the plant was known precisely, since the Russian system of planned quotas allowed a very specific amount to be stated. For this reason and because there was little likelihood of any competition from this source, Company HA considered that it was able to reduce the price it would otherwise have charged for the technology. The Russians were also fairly hard bargainers. One result of the Russian deal was that Company HA considered further deals with the Soviet Union and had set up an agreement with a British based organisation with good contacts in the USSR. This organisation was able to identify further potential licensable technology. Consideration of the Russian market is now a matter of policy for the company. The Russian agreement also led to a possibility of agreements with companies in China. Agreement with Western countries, however, on the licensing 'out' side were not company policy because of the dangers of setting up competitors. The only time this policy was not followed was in the case of a US company.

Company HA had no intention of licensing American companies to produce its products. However, it received an approach from an American company which had already endeavoured to design around one of the company's products. The proposition it put to Company HA was that if it did not sell its technology under licence, the US firm would copy it with modifications. However, since there was considerable know-how as well as patents involved the US company would rather come to an agreement. Company HA eventually accepted this proposition with relative equanimity and a licence was agreed. However, transferring the technology occupied a great deal of management time. The US company had not used the technology correctly and had also developed its own technology. The result of this was that the US firm tried to sell under the company trade name, products produced with their own process which were of an inferior quality to the UK product. Company HA also considered that its licensee priced these products in such a way as to undercut its own direct exports to the US, even though an element of price fixing had been a central, albeit informal, part of the agreement. This caused Company HA's market share to drop, although it was considered by the company that there was enough business for both companies if they had operated a collusive marketing policy. The pricing policy adopted by the US company eventually led to losses on the product line by the licensee and after a period of time they did raise their prices. Company HA therefore regained much of its market share, but in the interim period had lost a great deal of profit. The licensing 'out' agreement had not been a successful project.

In conclusion, Company HA used inward and outward licensing in a more reactive than proactive manner. However, the use of licensing has become a part of the strategy of the company to overcome resource constraints in both its product and market diversification policies. The company has identified licensing as a means of entering markets that would otherwise be closed to it.

In the absence of potential competition from producers in those markets (i.e. the Eastern Block) it has deemed the use of licensing valuable as providing a return from an otherwise closed market. Its experience of outward licensing in markets where direct export was an alternative, however, have been relatively unsuccessful. It seems likely therefore that in future a strategy of outward licensing will continue to be employed only in certain restricted markets.

The company has utilised inward licensing as a method of overcoming resource barriers that threatened to prevent itsdeveloping new products 'in-house'. Although this strategy was not particularly successful in producing a large profit for the company, this failure was deemed to be the result of poor marketing rather than through any failure of licensing per se. The company is therefore still considering utilising licensing in future new product development projects.

COMPANY JA

Respondent - Managing Director

Company JA [1] was incorporated as a private limited company in December 1975 when three members of a research team in a medium sixed engineering company decided to found their own company in the field of contract Research and Development. The company concentrated in its early stages on acting as a 'bridge' between the skills of local universities and 'in-house' expertise in materials testing and product development.

Following consolidation of initial company strengths, the company grew to employ over twenty people in the field of testing. In 1979 following lengthy prototype development work, a decision was made to become the manufacturer of a modular enclosure system which had been developed within the company for high specification, high hazard areas. This product was only a limited success financially but provided the company with the 'weight' and the credibility to raise finance for its next major development. Management had recognised that there were sufficient 'in-house' skills to support the development of a range of much more 'high technology' products than hitherto in the field of 'soft' automation, building these skills around the knowledge of an engineer newly recruited to the company. At the time of the case, the company employed 40 people.

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1. Company JA was identified through the 'Leverhulme' research reported in Chapter 6.

Following its decision to enter the field of automation, the company sought, through the UK university system for a suitable product for it to license 'in'. This led to 'in-depth' discussions with several universities and eventually to the identification of a suitable product at Surrey University. This was, effectively, a robot device running on mini-computer hardware. The major intellectual property involved was the software to control the robot and it was this that became the licensable property. At the time of the licence agreement the product was not in a form that could be marketed immediately however. The electronic and computer controls for the product occupied a space equivalent to a commercial road/rail transport container. It was therefore necessary for Company JA to develop and miniaturise the technology so that the product could be controlled by a micro-computer and would be able to be used for light assembly work in factories. In this development, the company worked very closely with personnel from the licensor, Surrey University. Without this back-up it seems unlikely that the product could have been developed quickly enough to fulfil the marketing objectives the company had set. By mid-1982 the new product had been developed and production commenced in small quantities in a new factory provided by the Welsh Development Agency.

According to the Managing Director, industrial robots have to be installed in such a way that they are able to carry out the particular task assigned to them yet be easily reprogrammed. Paradoxically, this comprises a highly labour intensive activity and hence a great deal of back-up is necessary to the purchaser of such a machine. This factor means that it is difficult to export robots unless there is a very high degree of support available locally from maintenance agents. Even then, however, it is often necessary for the manufacturer's technical personnel to be present at installation and 'running-in' of the machine. These characteristics preclude easy export. The company was therefore prepared to consider any proposal for licensing the developed machine 'out' to participating companies in other countries and in January 1984 entered negotiations with a Japanese Company. Negotiations were prolonged, but towards the end of 1984 an acceptable agreement for the transfer of the technology to Japan had been reached. At the time of writing it is not possible to evaluate the commercial success of the agreement, although technically the licence agreement has been successful and the technology transferred.

It has been company policy at all stages of the development to consider 'technology transfer', in its widest sense, as a means of developing company skills and strengths. This has not always taken the form of licensing agreements *per se*, but has included close co-operation with Universities and other research organisations. Licensing is seen as a more formal tool to be used where an informal approach is not appropriate, as in the case of licensing out to the Japanese. It has been company policy to obtain technology in a relatively undeveloped form and to develop it and license it out to others. This has been achieved in several cases beyond the mainstream licence activity reported in this case.

Company JA has used licensing highly proactively to break through technological and resource (or threshold) barriers in an endeavour to compete with much larger companies in the field of automation and allied development. As a result of its success in utilising licensing in this way, it was able in late 1983 to raise more than a million pounds in the City of London as equity and working capital. However, although the company has been very successful in a technical sense, commercially, sales of its robot based manufacturing systems have been disappointing.

Footnote

Company JA collapsed in May 1985 with debts of more than two million pounds. The testing division (the only profitable part of the business) was sold for 110 thousand pounds.

COMPANY KA

Respondent - Managing Director

Company KA[1] was set up soon after the 1939-45 war as a subsidiary of a large, vertically integrated group in the paper and publishing industry. The main reason for setting up the subsidiary was to provide support products, namely inks, to customers in the industry. Initially, the company provided inks and associated chemical products to other group companies which were mandated to purchase their ink supplies from Company KA. The company therefore had a secure customer base. However, transfer pricing problems arose within the group and the company also found itself unable to supply all the specialist inks that were required by other group companies without importing these from the United States. For this and other reasons, it was eventually encouraged to diversify both its products and markets.

During its growth in the 1950s and 1960s the company developed a strong research and development emphasis, based in large part upon extensive investment by the parent company. Within the industry, Company KA developed market leader expertise in several specialist areas. This expertise was recognised as one of the major strengths of the company. When in the late 1970s, the parent group decided

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1. Company KA was identified through the 'Leverhulme' research reported in Chapter 6.

to divest activities that were not part of its mainstream business, Company KA quickly found a buyer. A large American chemical company purchased Company KA for its technological expertise and to supply its requirements for ink in the European market, into which it was then expanding. The buying company had previously been a customer of Company KA.

At the time of the case study, Company KA employed approximately one hundred people of whom nearly ten per cent were involved in research and development. The company had a turnover of approximately £4 million per annum and was growing at an annual rate of twenty per cent. On average, in its main markets, the company had a market share of between fifteen and twenty per cent, although in several specialist market segments it was the market leader, with more than forty per cent market share.

Technology licensing has been an integral part of company operations for nearly twenty years. To an extent this is because licensing is an accepted method of operation within the speciality chemicals industry, but the Managing Director of Company KA stated that his company probably utilised licensing more proactively than others in the industry. The first licence that was taken on by the company (in 1965) was in response to its desire to diversify away from its traditional product lines. The licence came about fortuitously when Company KA was approached by a medium sized American company which had just launched an innovative ink for floor coverings. The American corporation was not, at that time, intending to export its product to the UK (or European) markets, but was willing to grant Company KA an exclusive licence for Europe, mainly in response to a request from one of its US customers which was setting up a plant in the UK and needed supplies of the specialist ink involved. Company KA found that the product fitted into its product portfolio. Under the agreement, initial supplies of the product were supplied to Company KA as agent, until its own production line was able to commence operations. The Managing Director states that although the ink industry is basically a formulative industry, there is usually a great deal of 'know-how' involved in transferring technology. In this case, the formulation led to some problems which were, however, overcome. A longer running problem involved obtaining supplies of the speciality chemicals involved in making the inks, since no UK supplier could be found for one particular ingredient. Initially this problem was overcome by importing chemicals from the US but a more suitable source in Western Europe was eventually found. The product now accounts for just less than 10% of total turnover.

Recently the company entered into two further inward licence agreements. These were both arranged by the new owners who wished to encourage the optimum use of their own (US) technology in all subsidiary companies. The flow of technology has, however, not been only one way, and Company KA has provided technology for its parent firm also under licensing agreements and to other group companies. This process has given it experience in the outward transfer of technology and the company has made use of this experience in agreements it has set up with other firms in the industry.

The outward licence agreements set up by Company KA have mainly been with third world countries and/or countries where the printing ink industry is less technically advanced than in the UK. However, inks, particularly specialty inks, are high value/low weight products, relatively easy to transport and hence, in most outward licence agreements, there is a danger of setting up competitors. Company KA has tried to overcome these problems by including restrictive clauses in its licence agreements. As a small company however,(although part of a larger group), it has been unable to police all its agreements adequately, and this has led to problems in enforcing its 're-export' clauses in some cases. However, the company has found that outward licensing can provide a useful method of exploiting markets from which it would otherwise be difficult to make a return.

In conclusion, Company KA has been relatively proactive in its use of technology licensing. The management of the firm recognised early that as a small concern it was unable to export to all potential markets. However, because of its R & D expertise built up over a long period of time, the company has been able to buy, develop and sell technology successfully, both to augment its product portfolio and enhance its 'in-house' R & D strengths and to obtain a return in distant markets.

Company KA has used licensing in a very professional manner. In part this clearly results from the resources available to it from its parent group services. However the company has also been very successful in managing the technology licensing process 'in-house' and clearly views licensing as an important part of its product/ market strategy for future development.

APPENDIX 6.4

'RANDOM' LICENSING CASES

COMPANY LA

Rathdown Industries (1) is a medium sized engineering company that has been forced by technological change to diversify away from its core strengths in mechanical engineering and into new electronic skills. For more than twenty years, to the early 1980's, the company produced specialised springs and metal pressings used in the telecommunications industry for switching equipment and meters. Although it made sales to several industries which required specialised springs, its main customer was the then UK Post Office (now British Telecom) which utilised Rathdown springs in its telephone (Strowger) exchange equipment. Some subcontract work was also done for other major companies in the industry.

As a result of the gradual change from electromechanical to electronic switching systems, the market for the company's products had been contracting for some years. However, as a result of the recession and a decision by the Post Office to phase out its electromechanical exchanges more quickly than anticipated, orders for Rathdown equipment were reduced by almost fifty percent in a short space of time. The company was faced with seeking new business in a field where technology induced obsolescence had reduced markets dramatically. Rationalisation of the company was

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(1) This case is a precis of two reports by Jason Crisp that appeared on the Technology Page of the Financial Times in 1982 and 1983.
30/7/82 - 'A Painful Leap into the Technological Age'
22/11/83 - 'How Rathdown Built on a Technological Turnround'

carried out, resulting in a loss of two thirds of the workforce of four hundred. Those with experience in the outmoded mechanical engineering skills comprised the largest proportion of these redundancies. The company was constrained to seek new products which would allow it to develop in the future.

Rathdown's Managing Director had been appointed several months prior to the crisis in order levels and had up to date experience in the electronics industry. He had been recruited from ITT and decided that the company must seek to develop new skills rather than find new markets for its old skills. As a result of this decision he approached the company's largest previous customer, British Telecom (BT) to identify a suitable product for sale to them, to endeavour to exploit the market the company knew. British Telecom was, at that time, seeking suppliers for a new electronic microphone to replace its current carbon microphone. Several UK and one Austrian company had submitted prototypes for evaluation by BT. The Austrian microphone had performed well in field tests but was not anticipated to win the contract for supply because of its foreign origins and the preference of BT to 'Buy British'. Rathdown therefore approached the Austrian company to seek a licence to manufacture the microphone on the basis of winning the BT contract. Negotiations for the license continued for nearly a year before agreement was reached, and three months after that agreement, Rathdown won a tender from BT to supply more than £2 million worth of microphones. The order was sufficient to provide a continuing workflow for nine months. However, although the company had won the contract on the technological excellence of the product, it had little manufacturing expertise in the area of electronic assembly. Personnel with the requisite expertise were recruited to manage the project. Further recruitment, of predominantly young female staff, was carried out to provide a workforce for the new product.

As a result of the new expertise obtained from the Austrian company, and utilising the acquired technology, Rathdown commenced a new product development programme to provide a continuing stream of new products. Outside consultants were used to assist in the design and development of these products - a 'call logger' and 'call timer' were the first of these. The products were developed in close collaboration with BT which remains by far the most important customer for the company's products. Collaboration has been extended to include meetings with BT prior to any product development. Rathdown suggests that BT finds a small supplier attractive "because it can make changes or meet different requirements quickly". As a result of the previous collaboration, Rathdown has developed products jointly with BT, licensing BT technology 'in' as required but licensing back the marketing rights of the products to BT in those markets outside the UK where it currently has no presence.

Rathdown initially utilised technology licensing in a reactive and *ad hoc* manner, as the result of a crisis within the firm. A strategy of licensing was then developed as a result of the success of the first license agreement. Inward licensing has assisted the firm in diversifying away from its previous base in outdated technology and to move into new areas of expertise. However, a major cause of the initial crisis within the firm was reliance upon one major customer, and the technological diversification embarked upon by the company has not been mirrored by a diversification in its markets. The company is therefore still vulnerable to changes in policy by its main customer. However, the broader product and skill base that the company has developed may allow market diversification to take place in the future. Several of the new products and those that are under development have a market beyond British Telecom and it is company policy to develop into markets other than BT.

Inward licensing possibly saved Rathdown from liquidation by giving the company enough time to allow it to develop new technological skills. However, possibly the major lesson of the case is that management was forced to recognise a requirement for development of those skills by outside events. As a result, the company has developed a long term strategy for its new product development programme, which did not exist before.

COMPANY MA

Respondents: Several including Managing Director and Technical Director

Company MA[1] is a small company producing hardware and software in the electronics field. The company was set up in the late 1970s as the service and maintenance division of a large company which produced a proprietary software product. As a division, the company was not particularly successful, although it provided a useful service to the parent company in maintaining that company's software products after sale to final users. However, the costs of running this service as a separate division proved to be a burden to the parent and decision was made to close the division down and transfer the service function back to the parent company.

Several of the managers of the division had established their families in the Manchester area, where the division was based, and were loth to move. They proposed that the division be reconstituted as a separate company, providing a service to the parent and to other companies and be the subject of a management buyout. The parent company readily agreed to this arrangement, although it retained a minority (30%) interest in the new concern. The company became independent in 1982.

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1. Company MA was identified through the author's involvement with the company as a consultant in 1985.

To generate an increased turnover, Company MA sought to build upon areas in which it perceived its strengths to lie. These included a sales force of two and four service engineers. Management decided to become agents for hardware and software products that complemented their existing skills and as a result of this decision visited several US computer trade fairs. Following these visits and the contacts that were made, company MA obtained agreement to sell five products in the UK. These were manufactured in the United States and shipped to the UK. The agencies provided an increased turnover for the company which became profitable shortly after becoming independent. Throughout 1981 and 1982 the company increased its size and by the end of 1983 employed ten people. It was then outgrowing its accommodation and began to seek larger offices.

One successful product that the company sold on behalf of an American manufacturer was an integrated hardware and software teaching aid, which had been licensed 'in' from an American inventor. The product which was software controlled comprised an add on unit to a micro-computer and was used to teach unskilled personnel how to use computer packages. In late 1983 the American company was taken over by a larger concern, which sought its technological expertise in micro-computers. The teaching product did not fit with the new owners' corporate plan and a decision was made to hive it off. The world manufacturing rights for the product were therefore offered to company MA, the largest distributor, in addition to current stock, which amounted to three months' average sales of the product in the UK. Company MA therefore had the opportunity to enter manufacturing with a product for which a substantial market already existed. The licence agreement granted rights to the product to Company MA on highly advantageous terms.

As a result of the agreement Company MA moved into larger office/ factory accommodation,north of Manchester, where it obtained substantial public sector support for setting up production and training new employees in light assembly work. In this it was substantially aided by its former parent concern which provided some manufacturing expertise in addition to a substantial amount of working capital. Sales of the product continued to grow and more assembly workers were recruited.

As a result of the success of the teaching aid product Company MA undertook a search for further products it could produce under licence. It commenced negotiations with those American manufacturers for whom it was acting as an agent. At the time this case was written two further products appeared likely to be produced under licence in the UK as the result of Company MA's expertise in manufacturing, as well as marketing products in the software/ hardware interface field.

Company MA developed its new product and licensing strategy as a result of circumstance rather than as part of any pre-conceived plan. This was particularly true early in the growth of the business. As the Managing Director remarked, the company's success had been based mainly on "being in the right place at the right time". The formation of the firm, its development into agency agreements and its diversification into manufacturing resulted from events external to the firm. However, the success of the initial licence agreement pointed the way to development of a strategy of new product development based upon the licence option. The firm sought products produced by reputable and fast growing US firms for sale under agency agreements and then sought to extend this co-operation into the licence field. This strategy was intended to reduce any necessary R & D expenditure to a minimum while obtaining 'state of the art' technology. R & D was restricted to customising American products for the British and European markets. This was crucial in the case of the first licensed product where development work led to an early improvement in the performance of the product and a reduction in its price through reducing the number of printed circuit boards involved in its manufacture.

Company MA initially utilised licensing in a reactive rather than proactive manner but has developed the use of licensed products as a method of maintaining technological leadership in its field. It is now an acknowledged market leader in the provision of 'interface' products (i.e. products which link micro-computers to other ancillary equipment).

COMPANY NA

Respondents: Managing Director and Financial Director

Company NA [1] is a medium sized, West Midlands based, engineering company. The company's main business is in supplying components for the automotive industry. The company was founded in the early 1930's during the first great expansion within the motor industry, by an individual who identified the potential for supplying particular parts to the larger car manufacturers. Over the following years the company expanded to its current size. It now employs approximately 200 people, with a turnover of £6 million per annum.

In the late 1950's the company lost its independence and was purchased by the Bowden Group of companies, and it was during this period that the company grew, in line with demand for its products and a general increase in economic activity. Its current parent company is the Adwest Group, a holding company which purchased company NA in 1970. The group gives a large amount of operating freedom to its companies and company NA is therefore able to develop its own strategies for expanding the business.

Currently the company produces in three areas - Hinges, Couplings and Seat Reclining Mechanisms. The Hinge product line accounted for more than 70% of turnover in 1984 although this proportion is falling as the company diversifies away from its current 'core'

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(1) Company NA was identified as a result of research being carried out for West Midlands County Council in 1985.

expertise. It is in the Hinge product area that the company has traditionally been involved. Company customers nearly all lie in the motor assembly business, and include both large and medium sized UK manufacturers and several of the smaller foreign car makers. As a result of strict application to quality control, induced in part as the result of the recession, company NA has developed a reputation for high quality products and for consistency and reliability within its field. Because of this, the company now lies near the top of the list of 'preferred' suppliers for several of its major customers. However competition from West German suppliers has proved difficult to overcome in markets outside the UK.

Product development has become increasingly important to the company during the past seven years as a result both of increasing competition due to recessionary pressures, and the determination of company management to grow through development into new market areas. Product development has occurred in three major ways. First, through in-house development and improvement of existing products. Second, through defining with customers and potential customers, new product needs, and designing to them. The third method has arisen as a result of approaches by customers offering company contracts for production runs of products which the company does not currently produce. The company is committed both to improving its current product range and developing into new areas of expertise and into new markets both through new product development and new product acquisition via purchase of other companies.

The company has utilised outward licensing extensively as an alternative to export for its seat reclining mechanism. This product was developed 'in-house' about seven years ago and arose as the result of a request by a customer for an alternative to its current (West German) supplier's product. Company NA designed around the West German supplier's patents and has built a strong patent position on its own product. However, the company found it difficult to compete on price with West German companies within Europe because of the high value of the pound sterling and has therefore resorted to outward licensing for export markets. The licensing option was, in any case, attractive to the company because of the high transport costs associated with the product. Currently, licence agreements account for more than thirty per-cent of the turnover on the seat reclining mechanism and for approximately five percent of total company turnover.

The first license agreement for the product was with an Australian company who approached company NA for the product licence rights. The company had already done a small amount of exporting to this customer, so an agreement was quickly reached to license the technology. This reactive licensing strategy has also character-ised the company's approach to utilising outward licensing. The company has now also licensed its product into South East Asia, Canada and the United States. A majority of the management and negotiation of the licence agreements has been done 'in-house' although the company has also utilised licensing consultants to advise it where necessary.

Following success with its licensees the company decided to become more <u>proactive</u> in its search for overseas partners and, in this regard, sought a consultant to assist it to break into the Japanese vehicle market. Negotiations for this license are continuing. Company NA has found that the use of licence consultants for this market has been useful in making the first approach to potential licensees, but also recognises disadvantages in their use. Defining to the consultant precisely what the objectives of the company are, has proved to be problematical and management now considers that the direct approach may be more effective for future negotiations.

In conclusion, company NA has built a reputation for technological excellence and reliability and is now searching for strategies to build upon that reputation and upon its 'in-house' technological strengths. Licensing is considered to be likely to become increasingly important to the company as it seeks to develop new products for its existing markets and new markets for its existing products. The company is currently seeking to become more broad based through a strategy of diversifying into new areas through a mixture of licensing and direct export. This process, and the research/development capability that the firm has built up, may lead, in management's view, to the company becoming more of a research and development organisation in the medium term, with manufacturing and contract R and D becoming complementary activities.

COMPANY PA

Respondent: Technical Director

Company PA (1) is a small West Midlands company, operating in a large number of product and market sectors. The company has developed to its current diversified situation through a series of changes over the last fifteen years, forced upon it by technological developments, the impact of the recession and through a policy of diversifying into new areas. The company's base technological expertise appears to be in its ability to make low technology metal based parts for a wide variety of applications. Currently it operates in the vehicle accessories, household goods, materials handling and luxury consumer goods markets.

Company PA was an old established family firm operating in the industrial chains market for nearly two hundred years. By the mid 1960's however, chain making had become a highly automated process and the company had diversified into heavy duty presswork and metal fabrication, producing parts for the motor industry, During the 1960's the company was profitable and this led to a takeover of the company by the Harrison Sheldon Group in 1969. The group had a philosophy of devolving control to the group companies and although the takeover had removed the influence of the family, the philosophy of the company remained virtually unchanged.

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(1) This case was identified as the result of work being carried out under contract to the West Midlands County Council in setting up the West Midlands Technology Transfer Centre.

In the late 1970's, the recession hit company PA very hard and substantial losses were incurred. This led to a major reorganisation at both company and group level. The company reduced its workforce from more than two hundred to less than one hundred employees. As a result of the recession the parent company also decided to merge another of the group companies with company PA. This company had been involved in the manufacture of motor vehicle and caravan accessories and had a very wide range of products from luxury picnic hampers to car and lorry wing mirrors. Although several of these products were very different from company PA's skills, others fitted in with their metal presswork and fabrication skills. Nevertheless, more than two thirds of the personnel of the second company had to be made redundant as a result of the merger.

In 1982 company PA started carrying out the construction by subcontract of a range of custom designed pallets for another local company. The pallet product fitted in well with company skills in metal presswork and fabrication. As a result of the financial problems that the customer company was experiencing, the pallet product range, including the name, drawings, patents and in two key cases, key personnel, was sold to company PA on its suggestion. Shortly thereafter, the original pallet manufacturer went into liquidation.

At this time, Company PA is divided into four divisions, each with its own sales/marketing force, but utilising central production facilities and a central management team. The divisions are as follows:

Division one	-	Motor Accessories	50% of total turnover
Division two	-	Picnic Hampers	10% of total turnover
Division three	-	Pallet Manufacture	20% of total turnover
Division four	-	Commercial Vehicle Fittings	20% of total turnover

The company is, therefore, highly diversified, although this diversification appears to have come about in a very _ad hoc_ manner rather than through the development of strategies to move into new markets _per se_.

In 1983/84 management decided to change its strategy towards new product development, which had, until that time, depended to a large extent upon the development of 'in house' design skills. It commenced a search for external sources of technological expertise. This led to a reallocation of the 'in house' design staff to other functions, although a small product _development_ team was retained. Subcontract R & D was to be used to fill in gaps in skill levels where necessary.

As a result of the change, company PA commenced a search for new products both within and outside the company. The search was based upon the perceived skills of the company in being "able to make any stamped/pressed/fabricated product from a design". This led to the development of several new products including a roof rack for gutterless cars and a new hitch mirror design for caravans. The first of these products was an 'in house' idea, but the development of the product was then contracted out to a commercial R & D company which produced designs and prototypes for the company This product is currently being brought into production with a target of 2000 units per year.

The second product arose as the result of an approach by an outside R & D company which wished to out license its design for a caravan hitch mirror. This product was based upon the application of new design principles and materials to an old problem (of aligning a towing vehicle to its load) and following negotiation, and further development, company PA took out a licence for the manufacture of the product. The agreement gave the licensor a small 'up front' fee and a six percent royalty on sales. The product was well received by both retail outlets and final customers, and sales are currently building up to the planned ten thousand units per year level. The company has had few problems in integrating the licensed product into either its manufacturing or marketing strategies. In the case of manufacturing, the workforce is highly flexible and able to turn to new products very quickly. As a result of the rationalisation programme, labour demarcation is not a problem. The company's sales force is also able to adapt to new products relatively easily, particularly, as in this case, where the new product line fits in with the current product portfolio.

Company PA has developed a strategy for the use of licensing, contract Research and Development and the use of design consultants, that complements its own 'in house' skills and expertise. Although the strategy has been developed in a rather reactive manner, in the light of the company's very diversified nature, and its <u>breadth</u> of skills, it has been able to utilise external technology relatively easily. However, the 'technology' concerned is of a rather low level, comprising the use of registered design copyright rather than the patenting of new ideas to protect intellectual property. The company sees its major strength in being able to make and market relatively low technology products competitively, rather than endeavouring to become a technological leader. Following its successes utilising outside technology it is now committed to develop such strategies in its longer term search for new products.

The case study suggests that for a smaller, non 'high technology' company, the use of outside skills can be an important factor in developing product lines. As a result of its new policy it is now being approached by other companies wishing to license products to it.

COMPANY QA

Company QA [1] is a small German Research and Development company that has grown out of manufacturing into marketing its technical expertise to larger companies in the rubber industry. The company dates from the late 1940's when the present Managing Director purchased the assets and goodwill of a small rubber stamp manufacturing company that had become bankrupt. Initially, the new owner continued to manufacture the products that the previous company had manufactured and this provided a reasonable return on the capital and effort employed.

Two years after the formation of the company, company QA purchased the rights to use the 'Semperit' process for the production of rubber stereo plates. In acquiring this process as licensee, company QA received very little assistance from the licensor in setting up the process. Although the technology was transferred, obtaining the requisite quality of final product proved to be difficult. Conditions within the industry were extremely competitive and obtaining assistance to develop the technology from sources within the rubber industry proved to be problematical. However, some of the suppliers of material, particularly the larger concerns, assisted company QA to overcome its technical problems, on the basis that the company was a small customer, likely to grow bigger.

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(1) The company QA case is the precis of a case study that appeared in Les Nouvelles, Journal of the Licensing Executive Society, September 1984.

Following success with the acquired technology and development of it, company QA developed a new technique for manufacturing rubber faced rollers for the printing, packaging, textile and other industries. The technology involved development both in the manufacture of the rubber compounds used in facing the steel rollers and, also, a more efficient method of applying the facing. Company QA recognised that it had an improved process that could be applied across a range of industries and hence would tend to undermine the current structure of its industry. At that time, the rubber roller industry was based on a large number of firms supplying small geographical markets. At the suggestion of a supplier company QA patented its technology on the basis of protecting its own manufacturing rights.

As a result of publicity within the industry, company QA received approaches from several major rubber roller manufacturers for the rights to utilise its technology under licence. The company recognised that it could exploit its technology either by manufacture 'in house' or under licence agreements, and in view of the large size of the market and its highly competitive nature, decided to follow the 'out' licensing route. The decision was reached in part because of the difficulty of identifying any infringement of patents that might be taking place within other manufacturing plants.

As a result of its decision to outlicense its technology, company QA approached one of the largest producers of rubber rollers for the paper industry, in West Germany, to offer its technology. Management recognised the advantage of the new technology and an agreement was quickly reached to install the process in its plants. However, one result of the new technology was a dramatic reduction in the numbers of personnel required to produce rubber rollers. This led to opposition, and even sabotage, from shop floor workers who perceived, rightly, that the new technology was a threat to their jobs. However, after some major problems, the technology was installed and the license was a success. Output was maintained at its previous level with a workforce reduced to a tenth of its previous size.

Following its first outward license, company QA drew up agreements with several large European companies in the industry. These agreements were negotiated by the company utilising its own 'in house' expertise. As a result, several of the agreements were not particularly 'professional' and, in retrospect, this could have led to later infringement of patents or licences but, in fact, no problems arose. Company QA rapidly increased the number of its licensees and the scope of the technology covered. The company's success led to imitation by several competitors in Europe, the United States and Japan. However, the original patent for the technology appears to have been particularly well drafted, and company QA has been able to protect its technology from encroachment.

The income from its licence agreements allowed company QA to further refine and develop its technology and, as a result, it has become a contract research/development company, concentrating on technology for the rubber industry. At the time of the case, the company had a total of sixty-nine licensees worldwide. The company's worldwide contacts have also allowed it to diversify into other technological areas and to other methods of operating. The company now also carries out a substantial business in buying, reconditioning and selling machinery for the rubber industry.

Company QA has utilised licensing in an extremely proactive manner worldwide although its first licensing agreement was reactive. The small size (40 employees) of the company forced early consideration of the use of licensing as the only feasible method of exploiting worldwide markets. As a result, company QA is now a world leader in its own technological field, and is able to retain that position by re-investing licence income in its Research and Development programme. Although the original patents, upon which the success of the company was built, have now lapsed, company QA has built up an ongoing patent portfolio which supports its current activities worldwide.

COMPANY RA

Respondent: Managing Director

Company RA (1) is an old established (1868), small (168 employees) West Midlands firm in the 'black ironmongery' field (latches, bolts etc.). The current phase in the company's development occurred in 1974 when the present Managing Director and a partner purchased the company from its original family shareholder. At this time the company was making 'reasonable' though not particularly high profits. The new management developed the range of builders' hardware that comprised the main product line of the company such that turnover increased threefold from its one third of a million pounds level in 1974.

In 1982 Company RA acquired two other similarly sized companies from the receiver. These companies produced goods in the field of metal enclosures (i.e. boxes) and in pallet racking and shelving systems. Since the first of the two acquisitions had occupied larger, more modern premises than Company RA, the three companies were combined on this site in 1983. Company RA also took advantage of the recession in purchasing a substantial number of machine tools, presses and other equipment which it stockpiled against future upturns in demand. Currently the company is divisionalised into four product areas as shown below.

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1. Company RA was identified as a result of consultancy work carried out for West Midlands Metropolitan Council in 1985.

- Black ironmongery - £1m turnover
- Metal enclosures - £1m turnover
- Engineering products £3/4 m turnover
- Pallet racking and shelving - £3/4m turnover

The company therefore manufactures a very wide range of goods including traditional mining hardware such as cast iron conveyor rollers and more 'high technology' products such as computer enclosures. The highly diversified nature of the company has made it difficult to market the whole range of goods through 'in house' resources. Agents are therefore employed both in the UK and overseas, although Company RA recognises that there may be substantial disadvantages in foregone profits in exploiting markets in this manner.

The Managing Director of Company RA suggested that his company had a unique set of skills including drawing office and drafting facilities, accurate metal forming capability, small and large assembly expertise and in depth knowledge of exporting procedures. However as a resultof the acquisitions the company had obtained a large amount of 'excess capacity,' and hence technology licensing was being considered as a method of utilising this capacity.

The company had two current experiences in the use of technology licensing. The first of these had arisen as the result of the metal closure company acquisition, when the purchased company was found to have the licence rights to produce a range of patented racking from a small American company. Although the product was technically advanced, the previous licensee had never made particularly effective sales penetration of the UK market in the product. The main reason for this appeared to be that a large amount of second hand racking had become available soon after the licence had been signed, because of the recession, and hence demand for new racking systems had slumped.

Company RA had resolved to develop the licensed product but encountered problems in this, since the original licence agreement did not contain clear clauses on assignment of licence rights if the original licensee ceased to trade. This also applied to the several sub-licensees in Europe who had continued to produce the product after the licensor's collapse but had failed to remit any royalty income to the new owners. Company RA was taking legal action against one sub-licensee to enforce these rights. However in view of the small percentage of the company's turnover attributable to the product in the UK (less than 2%) action to clarify legal position had not been pursued very strongly. This position was anticipated to change as the company developed a new marketing strategy for the product. A further potential problem arose when the American licensor was purchased by another company. Although the legal position on the use of the licence is still not entirely clear, the licensor has not taken any steps to prevent Company RA from manufacturing its product. The Managing Director believed that if the new marketing campaign for the product was successful and substantial turnover began to be generated on the racking product, the licensor might endeavour to enforce his rights through recourse to law. This would be resisted.

The second licence agreement was still being negotiated at the time of the case study. As part of its search for new products and activities to utilise its excess capacity, Company RA had approached various contract research companies and facilitating agencies, to identify other opportunities. One of these agencies was the British Technology Group (BTG). Company RA had spcified the type of products it was seeking and in late 1984 the BTG approached the company with an innovative electronic security bolt system. This product had been developed at the Building Research Establisment (BRE) at Garston and appeared, in principle, to be suitable for manufacture by the company. However, the new product would require skills in electronics that the company did not currently possess, as well as expertise within its current areas of competence. The company had decided to take a licence for the product and negotiations were continuing towards that end. However, the company was concerned that it may lack the particular marketing expertise to exploit the product successfully. It recognises that a more proactive marketing strategy than the use of agents will have to be developed.

Company RA has decided to utilise technology licensing as a means of employing its spare manufacturing capacity. Although the company is covering its overhead costs, its profit levels are relatively low and hence it is seeking to increase turnover both quickly and by a large percentage (30%). Its current product lines are unlikely to be able to generate this level of growth, although they provide a continuing steady turnover from low technology markets. As a result of this the company has increasingly considered sources outside the company to provide new product opportunities (including licensing). The company has a small drafting and R & D capability and the Managing Director believes that it would be able to redevelop and assimilate any new product technology relatively easily. His major objective is to reduce the current reliance on sub-contracting for original equipment manufacturers (OEMs) and substitute 'own brand' products of a higher technological profile than currently.

In conclusion, Company RA is now developing strategies to develop its business after a major period of acquisition and rationalisation of historical activities. Inward licensing is recognised as a potentially important method of developing into new 'higher technology' market segments, to build upon current 'in house' strengths. However, the company appears to have a rather 'ad-hoc' strategy in this area, following up licensing and other new project leads in a rather haphazard manner across a wide range of technologies and disciplines rather than identifying particular market segments into which it wishes to develop. Company management recognises that it has a fairly unstructured approach to diversification but considers this to be more of a strength than a weakness, in exposing the company to a wide variety of potential projects. This approach has mainly arisen from the Managing Director's previous business experience and his belief that his ability 'to pick winners' from a large variety of projects is more likely to be successful than a more planned approach.

COMPANY SA

Respondent: Managing Director

Company SA[1] is a small, old established family business. The company was set up in the late eighteenth century (1776) to make whip thongs for carriage horse whips. In the early 1900s and following development into other areas, the company diversified into the production of tube bending and other special purpose machines on a 'one-off' basis. Currently, four members of the family remain directors of the company, holding a large majority of the equity. The company currently employs just over one hundred people, and has a turnover of about £4 million per annum.

In the early 1950s a design engineer in the company designed a range of special purpose heavy duty cast steel purpose clamps for use within the manufacturing facilities, to hold components being worked on. Following the suggestion by a supplier that these could find more general applicability, the company began to market the clamps as an adjunct to its range of purpose built machinery. Over the following twenty years the clamps grew to become a significant part of the company's business. In 1972 following several years of falling sales for specialist machine tools, the machine tool business was sold off to a larger concern

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1. Company SA was identified as a result of consultancy work carried out for West Midlands Council in 1985.

in the West Midlands. Of this side of the business only the Researach and Development function was retained. The sale had been foreseen by management which had concentrated upon building up the 'clamp' side of the business. However, it had been clear that clamps alone would not provide a sufficiently large turnover for the business, and hence a search had been instituted for products into which the firm could diversify.

In 1969, one of the directors, a keen caravanner, had visited a caravan exhibition in Oslo (Norway). At this exhibition he had met the German manufacturer of a range of caravan space heaters, equipment not then widely available in the United Kingdom. This individual was seeking agents in other European countries for his products. Following negotiations, company SA came to an agreement to market the heaters in the UK. It soon became clear, however, that UK assembly of the heaters under licence would be more appropriate thanimport of complete units, and in 1975 Company SA commenced assembly using mainly German components. In the ten years prior to the case, Company SA progressively reduced the amount of German components in the product and currently only the heat exchanger is provided by the German licensor. Patents and design copyright on this sub-unit precludes Company SA from manufacturing the component, although the costs of setting up dies for manufacture in the UK at a estimated £60,000 are also considered prohibitive.

The changes in the terms of the agreement with the German licensor contingent upon the change from franchisee to licensee, led to the necessity for several re-negotiations. As the company developed the UK market for caravan space heaters (in which it is now market leader with more than 80% market share) it was able to reduce progressively the proportion of the 'market profit' going to the licensor. Currently Company SA pays a royalty rate of about 2 1/2% on turnover on the product. This represents a fixed charge on each heat exchanger purchased from the licensor and is, therefore, a constantly reducing charge to the company as inflation increases the unit price of the complete product. It seems clear that the licensor would prefer to obtain a higher return on his licence agreement, but is unable to do so because of the danger that if the agreement is broken and Company SA produces its own heat exchangers, the company will be in a strong position to commence export operations into the licensor's own market. Effectively, by granting a manufacturing licence, the licensor has set up a competitor company in the UK.

The caravan space heater provided the basis for a family of products in the caravan heating and other caravan accessory field. Company SA utilised its extensive 'in-house' R & D capabilities (it currently has eight staff out of one hundred, employed in this field) to develop other, parallel products, such as caravan water heaters, boat heaters, shower heaters, lights and other accessories. The company is now the overwhelmingly dominant monopoly supplier in its own market segment within the UK. The caravan heater range now accounts for more than seventy five per cent of turnover, with the clamps business providing the other twenty five per cent.

However, Company SA management recognises that the possibilities for developing in their own market are now restricted, since the products account for such a large proportion of that market. The company is, therefore, currently considering how it can best diversify into other fields. Two major strategies have been proposed. The first of these is to develop completely new product ranges for the caravan accessory market. However, in the UK the caravan market is fairly static and in view of their current dependence on that market, management considers that further development in it could be a relatively high risk option. The second potential avenue for development is considered to be entry into other markets with current product ranges. This would involve Company SA in producing domestic and industrial 'through wall' heaters. This strategy is also considered relatively high risk, since the domestic heating market is dominated by companies much larger than Company SA. Company management has decided to follow the second alternative however, and is currently developing its current products to attack this market.

Company SA has also utilised outward licensing on two occasions, for its range of clamps. Neither of these instances was a great success however. The first outward licence was to a South African company which approached Company SA for the rights to use its registered designs to produce a range of clamps for that market. Negotiations were conducted on an 'arms length' basis following one initial visit by the licensee to the UK. However, the South African licensee failed to develop the business successfully, and the agreement never became profitable and has now lapsed.

The second outward licence was to a New Zealand company and once again was a failure. In this case, quality control was a problem. Although the clamp range was relatively 'low technology' being based on traditional cast steel techniques, it was clear that a great deal of 'know-how' had never been transferred. The agreement transferred detailed drawings and mould patterns to the licensee. Following a year of poor quality production the agreement was terminated by mutual agreement. However, it seems apparent that the New Zealand licensee had made the technology available to another local company without company SA's permission. Soon after the licence lapsed a range of clamps was introduced to world markets by another New Zealand company. Company SA decided to attack this competitor on quality grounds and has not lost major market share to the competitor. However the company's experience of <u>outward</u> licensing has made it very wary of using the technique again.

In conclusion, Company SA has utilised both inward and outward licensing on a proactive basis. Its success in inward licensing has allowed the company to move over a period of ten years away from its traditional 'core' strengths and into new areas. It is currently considering the use of licensing again in its search for new products. However it has not carried out a search for new licences in a particularly positive manner. Its experiences of outward licensing have been unsuccessful, and it is unlikely that the company would consider this strategy again.

COMPANY TA

Respondents - Sales Director, Technical Director and Marketing Manager

Company TA (1) is a small/medium sized West Midlands based company. The company provides a range of electroplating, metal finishing, heat treatment and thermo-chemical surface treatments at fourteen plants throughout the UK. The company is split into four divisions, each one providing one of the above services. The company was set up as a family concern before the Second World War but is now owned by a conglomerate company. Company TA currently employs three hundred and sixteen employees in the UK. Four of these are employed in the company's R & D department in Birmingham.

At the time of this case study the company was growing fast, having expanded from a base of three plants in 1981 to its current fourteen plants. This process has been developed as part of a growth strategy by company management to provide a 'countrywide' service to its customers. The strategy has been supported by recruiting 'high flying' executives with exceptional track records to manage the growth of the company.

1. Company TA was identified as a result of consultancy work carried out for West Midlands Metropolitan Council in 1985.

Growth has been achieved in a number of ways. First, quality control procedures have been improved. The respondents state that Company TA is now market leader in the UK in its field with a reputation for high quality, a large range of processes offered, and keen pricing. It has thus been able to compete successfully with other locally based 'job shop' chromium plating and metal treatment companies.

Secondly, Company TA has grown by acquisition. Its latest acquisition was another small company, purchased in 1984 for its special expertise in electroplating This company now comprises one of the divisions noted above. It is Company TA's objective to develop the range of skills it offers by further acquisition.

Thirdly, the company has developed the range of metal treatments that it can offer. Although its original 'core' technologies of chromium and nickel plating still account for fifty per cent of total turnover, the company now offers a range of more than fifty different treatments. Where these treatments cannot be offered locally, the company's efficient distribution service allows for components to be treated at its Birmingham works. As a result of the range of services on offer, Company TA has been able to obtain a large amount of work on a sub-contract basis that customers had previously carried out 'in-house'. Recessionary pressures in the early 1980s accentuated this process as customer companies closed 'in-house' facilities in favour of processes that could be carried out more cheaply under sub-contract outside. The company has also developed its 'in-house' skills in engineering, allowing it to provide a design, prototype and development facility for customers. This complements its treatment facilities. The company also produces its own chromium plated bars for use in the hydraulic industry. This manufacturing activity, however, comprises only a small percentage of company turnover, but complements its main sub-contract treatment business.

The last method of growth has been through inward licensing agreements. Company TA has two substantial agreements of this type. The first of these comprises a nitriding treatment for hardening iron and steel components and was licensed from a French company in 1978. The company was at that time seeking to develop its skills in this area. The technology was licensed in, in preference to alternative technology from a German competitor. Company TA carried out extensive research into the potential of the technology before it took out a licence. This process and the negotiations leading to the agreement being signed took more than 18 months. Company TA considered that it could improve the process, and following agreement it further developed the technology utilising its own 'in-house' expertise. In view of the substantial changes made to the technology, the French licensor agreed that no 'up front' fee be paid. Royalties on turnover accruing to the process were paid however, at four per cent of turnover. Currently the process accounts for approximately three hundred thousand pounds of turnover per annum, or about three per cent of total turnover. Of this, about one third comprises work carried out 'in-house' and about two thirds comprises sub-contract work. Company TA has substantially improved the technology since it was licensed, and has patented some of these improvements. Although the initial agreement did not haave any formal 'cross licensing' or 'grant back' the company has, in practice, transferred technology back to the licensor, and further developments have also been transmitted to it by the licensor. The licence has been responsible for giving Company TA a small though useful turnover in a new market segment.

The second licensed product, the main subject of this case study, is likely to prove to be a very significant diversification for the company. The company is to launch the licensed process in the UK in June 1985 at a press conference which three hundred UK engineers are expected to attend. In late 1983 the company in its capacity as a (the) major metal treatment company in the UK, was approached by Toyota Research and Development Division (Japan). The Japanese company was seeking to obtain UK coverage for its Toyota diffusion (DF) process. The process provided an effective method for hardening ferrous components, particularly tools for machining other metals. Toyota saw Company TA, with its (then) 12 plants and nationwide coverage, as a potentially successful partner to exploit the technology. In the UK, the Japanese had twelve patents protecting their technology, hence it would have been difficult to develop parallel technology.

Following the initial approach, Company TA sought advice on the potential of the process from its local (Aston) University. It discovered that staff at Aston had been working on the process under a development licence from Toyota for three years. It also discovered that several of the major motor manufacturers and engineering companies in the UK had been offered and had considered the process, but had rejected it. Company TA therefore approached the licence negotiations with a degree of caution. It found that the process had been extremely successful in Japan, where the technology had been extensively used to harden tools used in many industries. The process had also been licensed to other countries.

After twelve months' negotiation, during which Company TA carried out extensive market research and technical feasibility studies, the company signed an agreement to utilise the technology in January 1985. Under the agreement no equipment was provided, only blueprints, patents and some technical expertise. Company TA paid the licensor a 'substantial' up front fee and agreed to pay royalties on a sliding scale commencing at eight per cent for low volumes and reducing to five per cent at higher volumes. It expended more than £60,000 building a prototype treatment plant. The total project cost was about £100,000. At the time of this case study (May 1985) the company has a small plant operating in Birmingham. First orders for sub-contract work utilising the technology will be accepted in June 1985 and the company anticipates that demand for treated components will outstrip the capacity of its first plant. If demand follows the pattern of that in Japan and other markets, larger facilities will have to be built quickly. Company TA anticipates that the technology will become a central part of its UK operations.

Company TA does not have an exclusive licence for the technology in the UK. If demand does become very large, Company TA does not have the right to prevent a large customer (for example) from also licensing the process 'in' from Toyota. Company TA has, however, received verbal and written assurances that if this situation arises it will either be able to veto further licences or receive payment for lost business. In view of the perceived advantages of sub-contracting treatment services rather than carrying them out 'in-house' the case respondents did not see this situation as a major threat.

In conclusion, Company TA has used inward technology licensing to enhance and support its growth and development strategies. It has not been highly proactive in its use of licensing however. Following its first licensing success it did commence a small scale search for other licences, but this was never followed through. Subscriptions to data bases and licensing publications (for example) were taken out, but this process did not identify potentially attractive propositions. Company TA has, therefore, been willing to consider the use of licensing when good propositions were put before it. It does not, however, see licensing as <u>the</u> central part of its development strategy, but as a useful adjunct to it.

COMPANY UA

Respondent: Chairman/Managing Director

Company UA[1] is a small/medium sized company in the carpet industry, located in Kidderminster. The company carries out manufacture of yarn and weaves, finishes, distributes and markets carpets, so it is relatively highly vertically integrated. Currently the company produces and sells to the following markets - (a) Retail - 45% of turnover, (b) Contract Office and Shop fitting - 35% of turnover and (c) Export - 20% of turnover. The company was founded in 1869 and remains in the hands of family and other small shareholders. It employs three hundred and sixty eight people.

Company UA is the market leader in its own market segment of patterned broadloom tufted carpet. The Managing Directors suggest that it has attained and retained this position through purchasing the latest technology either as machinery or under licence agreements, and through co-operation with technological leaders in the field, mainly in the United States. The company has also made extensive use of outside design consultants to provide 'fashion' patterns for its carpets, and has used several UK universities in developing its own technology. It is company

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1. Company UA was identified through a seminar run by Bath Management School, in Aston University, in April 1985

policy to recruit numbers of University graduates every year. University students are also encouraged to work within the company on industrial placements for six month periods.

Company UA has made use of inward technology licensing and is also currently evaluating a proposition to license its technology 'out' to India. The first inward licence came about when the world leader in carpet technology, an American company called Deering Milliken, introduced a new process for rapidly building up carpet designs based on a computer controlled die injection nozzle machine. This process injected a pattern to the base of the tufts in tufted carpets and hence was a major advance over printed patterns where the pattern does not reach the base material. The technology had been developed from rocket nozzle/ fuel injection techniques originally designed by the National Aeronautical and Space Administration (NASA) in the Apollo Moon Programme. The technology made use of a 'Hydra Shift Machine' to produce a narrow (1 metre) carpet.

Under the terms of the licence, Company UA received a production machine from the licensor, plus some technical back-up in achieving volume production. The American licensor was willing to license its technology because the cost of transporting carpet to the UK was uneconomic. However, the technology had several disadvantages. First, one metre width carpet was relatively narrow and the company therefore wished further to develop the technology 'in-house' to increase this to three metre width. Secondly, each pattern making design was incorporated into a microchip based in the micro-computer controls of the machine. For every new pattern, Company UA had to obtain another microchip from its supplier, although it could specify what that pattern should be. This allowed the licensor to control his technology but the costs of obtaining new patterns, and more importantly, the time involved, led to production delays in producing samples for customers and hence was not completely satisfactory to Company UA. The agreement was also somewhat onerous in restricting use of the technology to Company UA. No sale of the technology to others was allowed.

As a result of these restrictions Company UA embarked on a strategy of developing its own technology, based on the licensed technology, but improving on it. This involved, as suggested above, an increase in carpet widths produced, but more importantly comprised a computer based technological development. The Company designed a system whereby patterns could be built up on a screen and transmitted direct to the carpet making machine. This was effectively a computer aided design/computer aided manufacturing system. In this development the company also made use of technology bought in from another UK manufacturing company. In this case the licence agreement was non-exclusive and company UA was less restricted in the use it could make of the technology. Once again the technique was based on 'embodied' technology in a micro-computer software system, but the company was able to develop this 'in-house' relatively easily.

Company UA further entrenched its market leader position through the use of its licensed and 'in-house' developed technology. In 1984 it was approached by an Indian carpet manufacturer seeking a licence to set up a tufted carpet operation. Company UA was reluctant to consider licensing its newly developed technology out. However, it offered to license its more traditional production technology to India on the basis of a 'turnkey' operation rather than a licence of technology per se. It considered the 'turnkey' approach to be more appropriate because (a) it would receive a 'package' price for the technology rather than royalty income on production which it believed would be difficult to monitor, (b) it would be better able to control the transfer of technology and ensure the success of the venture and (c) it would be able to use the out-licence process for its existing (obsolescent) production equipment, allowing it to re-equip its UK factories with the new process machinery it had developed. At the time of the case study the company had been negotiating with its potential partner over a period of six months and negotiations were relatively far advanced. The Managing Director believed that an agreement would be signed 'within the next three months'. Negotiations had intensified following the simplifying of the Indian Government 'licensing' system for the import and exploitation of foreign technology.

In conclusion Company UA recognised the value that inward and outward licensing could play in its product and market development policies. In view of the complexity of the technology involved and because of the company's status as a producer of carpets rather than production machinery, the technology transferred in both inward and outward cases was basically 'embodied' within machinery. However, Company UA had developed extensive 'in-house' skills in taking such technology and further developing it for its own carpet production processes. The Managing Director believed that in this the company had advantages over the machine manufacturers in building up expertise in production technology in conjunction with mechanical engineering skills. It had been his policy therefore to seek out and recruit individuals with such skills from the machinery manufacturers to complement his existing labour force skills. This mix of bought in skills, licensed technology and development of in-house expertise appeared to have been highly successful. In 1983, the company had made a profit of 7% on turnover of £13 million at a time when a majority of the other UK carpet producers were either merely breaking even or were incurring large losses.

COMPANY VA

Respondents: Managing Director and Manufacturing Director

Company VA[1] is one part of a small, old established West Midlands group of companies. The company was founded in the early nineteenth century to produce forged and other forms of ironwork. By the 1970s the group had passed through a number of hands and them comprised three main subsidiaries. These were as follows:

Subsidiary A - Presswork (for the motor industry)

Subsidiary B - Precision Engineering (mainly for the aircraft industry)

Subsidiary C - Metal Cabinet Making and other high quality presswork (Company VA subject of this case)

In the early 1980s the group decided to set up a fourth subsidiary. This was built around a joint venture with an American company to develop and utilise composite materials as an alternative to pressed metal components. The new division commenced development of 'high technology' carbon fibre and other materials.

By the beginning of 1983, the composite company had still not made a profit and, indeed, was acting as as a cash sink for profits from the other subsidiaries. Company VA, the most profitable subsidiary, found that it was being used as a 'cash cow' to provide development funding

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1. Company VA was identified through consultancy work carried out for the West Midlands Council in 1985.

for the composite company. Company VA management became unhappy at this situation and suggested to the group that it become subject of a management buyout which would both release funding for further development of composites and also give Company VA management a chance to develop their business into new areas, free from group control. This was agreed in principle as part of the reconstruction of the group and in conjunction with group bankers. The West Midlands Enterprise Board is to take a major stake in the company. It is anticipated that company VA will become independent in mid 1985, although it has had *de facto* independence in all areas except finance, for more than ten years. At the time of the case study, company VA had a turnover of approximately four million pounds per annum, and employed one hundred and twenty people. The company had an order book of six months' production equivalent and was producing a good profit from its traditional product lines. These comprised high quality metal pressings for cabinets and casings, mainly for the telecommunications industry. The company's major customers are British Telecom and other large electronics companies.

However, although the company was profitable, management recognised threats from two separate directions. First, deregulation of the Telecommunications Industry and denationalisation of British Telecom had opened a previously protected market to foreign competition and hence the market was changing. Although company VA believed that it would be able to prosper because of its technically excellent products, management recognised the need to diversify away from reliance upon its previous major customer(s). and away from its somewhat concentrated product lines. A second, possibly longer term, threat recognised by executives comprised the emergence of new materials as alternatives to metal pressings. These included moulded glass reinforced plastic, and new 'high technology' materials such as carbon fibre which were, as noted above, also being developed by another group company.

Company VA developed a strategy to counter these threats in three ways. First it undertook a major modernisation and re-equipping of its traditional manufacturing activities. Computer aided design and manufacturing equipment was purchased and quality control procedures improved. Second, the company set up a small unit to develop downstream into producing more than 'boxes' for products, but also to provide the electronics to go in those boxes. The company recruited two experienced electronic engineers for this purpose, one from British Telecom, and one from Westinghouse. These individuals obtained work in subcontract assembly, including wiring harnesses, and in component insertion for printed circuit boards. The company also retained PA Technology Centre to design a product in response to a call for tenders from British Telecom. Although a product design was completed successfully, the company failed to obtain the tender because the price it quoted was too high. Lastly, the company set out to seek products that could be made under license and which would complement, but be different from, current product lines. This process has been developed through the use of industry contacts, the use of the Centre for Innovation in Industry and the services of a consultant. However, although the company currently receives an average of ten 'product offers' per week, very few of these have proved suitable in practice, for exploitation by the company. A major problem lies in 'Anglicising' foreign products for the UK market.

This has been particularly important in the case of American products with their different standards. The company is seeking tele-communications products that it will be able to sell to its existing 'box' customers. However, the company has had some success in this area. Over the past year it has completed two licence agreements and is negotiating a third.

The first licence agreement took the form of a franchise/licence agreement with Phillips in Holland. The latter company had developed a new housing for a range of electronic telephoneexchange equipment and was seeking to market the product in the UK. Company VA approached Phillips, initially on the basis of a franchise agreement, to market the equipment. However, in view of the transport costs involved in moving what was effectively an empty box from Holland to England, the company quickly sought to produce the product under license. Although negotiations were protracted, and involved several visits by executives to Holland over a six month period, agreement was finally reached. The company is currently setting up manufacturing facilities to produce the product.

The second agreement involved a 'carrying case' for large electronic test equipment. This was a market the company knew well, but was a diversification for it, since the material involved in the 'box' was reinforced plastic, not steel sheet. Once again, the franchise/licence route was adopted. Company VA is currently marketing the cabinets and is tooling up to produce them 'in house'. Plastic moulding is to be subcontracted out, while internal metal housings will be manufactured and all assembly carried out 'in house'.

The third product, for which negotiations had, at the time of the case, been carried out for about six months, is a new racking system, designed by the General Electric Company. Company VA has negotiated the UK and European rights to manufacture and market the product. It is anticipated that an agreement will shortly be signed. The product complements company VA's current skills, while developing them into new areas. The 'racking' system encompasses a degree of electrical work, particularly in the provision of wiring harnesses, produced integrally with the racking. An integral cooling system is also incorporated to remove heat produced by the operation of components in the 'rack'.

Although the three licensed products are all new to the company, management believes that they will provide a 'significant' turnover (i.e. more than ten per cent) within a two year period. The company is committed to identifying other, similar products for it to diversifyinto, through the use of licensing.

In conclusion, company VA has developed a long term strategy to diversify away from its 'core' but relatively low level technological skills and to build its business through incremental movement into new areas. Management believes that it has a major strength in its market contacts with end users of sophisticated electronic test and similar equipment. The company wishes to carry out joint exploitation of this market with other companies, with complementary skills. In this development, it has used and intends to use technology licensing as a strategic tool to assist it in the acquisition of such skills. Other methods of technology transfer are also under consideration. The company is considering further use of new product design consultants (such as PA Technology) and is also considering approaching local universities for technical assistance in product development. Its new product strategy has, therefore, been based on following a variety of new product options built around the use of technology licensing and other technology sources to supplement its own 'in house' R and D expertise.

APPENDIX 6.5

SUMMARY CASE ANALYSES

COMPANY A *[1]

1	Company Type	Small, growing, entrepreneurial
2	Ownership	Owner managed
3	Size (employees)	50
4	Age (years)	17
5	Classification [2]	Specialised - non-diversifying
6	Management Type	Centralised
7	Competition	Low
8	Growth Profile	Expanding
9	Industry	Electronics
10	Market Type	Close links with public utilities - its main markets
11	Licenses (in/out)	IN
12	Number of licences	2
13	Licensed Products	Cable detector, portable dosemeter
14	'Boston' Classification for Licensed Products	Product 1 - Star Product 2 - Problem
15	Policy Objective of the Company	To grow within its current management capabilities. To develop key skills in particular technologies.
16	Company Product Profile	High technology, small batch products for large customers. Highly profitable products. - Code B (3)
17	Technology & New Product Strategy	To obtain part developed technology from public utilities and build upon this base. - Code P (3)
18	Initial Use of Licensing	Proactive
19	Licensing as part of Company Strategy	Considered as the major source of new technology. - Code A (3)
20	Process of Licensing	Inward licensing through close contacts with major customers

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1. * Denotes case company initially visited jointly by the author and Julian Lowe

2. Classification of Company - See Chapter Four

3. Code letters refer to analysis Tables 6.16/6.17/6.19 Chapter Six.

COMPANY B *

1	Company Type	Small, old established company
2	Ownership	Subsidiary
3	Size (employees)	115
4	Age (years)	45
5	Classification	Specialised, diversifying
6	Management Type	Participatory
7	Competition	High
8	Growth Profile	Expanding
9	Industry	Mechanical engineering - valves
10	Market Type	Main market hard hit by recession but Company B segment on growth curve
11	Licences (in/out)	IN
12	Number of Licences	2
13	Licensed Products	Control valves
14	'Boston' Classification for Licensed Products	Cash cows
15	Policy Objectives of the Company	To be a market leader in its own small market segment, but not to grow so large as to become uncontrollable.
16	Company Product Profile	Control valves. Two product lines Highly profitable but investment required in others. - Code M
17	Technology & New Product Strategy	To achieve technological leadership through a continuous process of developing small numbers of new products at rate of 1 - 2 per year. - Code D
18	Initial Use of Licensing	Proactive
19	Licensing as part of Company Strategy	Always considered, following initial ad hoc use of licensing via the use of consultants. Licensing not a major part of strategy. - Code A
20	Process of Licensing	Purchase of technology to fill gap in product line, then further development. This was a highly successful, proactive use of licensing in the two instances where used.

COMPANY C

1	Company Type	Entrepreneurial company set up to take advantage of licensing opportunity
2	Ownership	Subsidiary
3	Size (employees)	190
4	Age (years)	25
5	Classification	Specialised - non-diversifying
6	Management Type	Participatory
7	Competition	Medium
8	Growth Profile	Expanding
9	Industry	Furniture - wood particle, moulded board
10	Market Type	Growth market previously, now slowing down
11	Licenses (in/out)	IN
12	Number of Licences	3
13	Licensed Products	Wood particle moulding process
14	'Boston' Classification of Licensed Products	All products 'Stars'
15	Policy Objectives of the Company	To grow as fast as possible, following previous development patterns
16	Company Product Profile	Small range of profitable products. Development work on new lines continuing. - Code M
17	Technology & New Product Strategy	To retain and extend present technological leadership through the introduction of new products based on existing licensed technology and improvements to this. - Code P
18	Initial Use of Licensing	Proactive
19	Licensing as part of Company Strategy	Licensing as central core of company strategy, with extensive cross licensing agreements. - Code G
20	Process of Licensing	Cooperative agreement with licensor and other licensees to exchange technological advances has been highly successful policy for both parties.

COMPANY D*

1	Company Type	Originally a family firm, recently taken over
2	Ownership	Subsidiary
3	Size (employees)	95
4	Age (years)	19
5	Classification	Specialised - diversifying
6	Management Type	Participatory
7	Competition	High
8	Growth Profile	Static
9	Industry	Plastics - maintenance free building products
10	Market Type	Growth market but high levels of competition. 'Low technology'
11	Licences (in/out)	IN
12	Number of Licences	3
13	Licensed Products	Plastic building products
14	'Boston' Classification for Licensed Products	All products 'Cash Cows'
15	Policy Objectives of the Company	To grow larger in diversified ways within the GRP and maintenance free buildings products industry
16	Company Product Profile	Large range of mature though profitable products. Good mature: developed ratio - Code M
17	Technology and New Product Strategy	To utilise existing skills. Not to become involved in high technology but to grow through exploitation of marketing flair and to introduce a large diverse range of new products. - Code H
18	Initial Use of Licensing	Reactive
19	Licensing as part of Company Strategy	Always considered and utilised as a matter of course where available. Opportunities sought as a continuous process. - Code A
20	Process of Licensing	Technology transfer relatively simple within the industry because of technology type. Licensing of designs rather than processes in most cases. Licensing has been a useful addition to other forms of market realisation for Company D.

COMPANY E*

1	Company Type	Fast growth company recently subject of management buy-out
2	Ownership	Owner managed
3	Size (employees)	38
4	Age (years)	5
5	Classification	Non specialised
6	Management Type	Participatory
7	Competition	High
8	Growth Profile	Expanding
9	Industry	Industrial filters
10	Market Type	Slow growth but increasingly important to other industries
11	Licenses (in/out)	IN
12	Number of Licences	1
13	Licensed Products	Porous irrigation hose
14	'Boston' Classification for Licensed Products	'Cash cow'
15	Policy Objectives for the Company	To grow fast and increase profitability through any avenue that might be successful
16	Company Product Profile	One major profitable product line. Several minor products being developed. - Code M
17	Technology and New Product Strategy	To market high technology, high value, high growth potential products and to introduce new diversified products on a regular basis through product life cycle and other analysis. - Code P
18	Initial Use of Licensing	Reactive
19	Licensing as Part of Company Strategy	Not usually considered except where licences offered to the company. - Code I
20	Process of Licensing	Ad hoc generally reactive, but seen in context of other techniques. Has been very successful in introducing diversified products to company.

COMPANY F

1	Company Type	Subsidiary company run by 'imported' management
2	Ownership	Subsidiary
3	Size (employees)	200
4	Age (years)	17
5	Classification	Specialised - non-diversifying
6	Management Type	Autocratic
7	Competition	Medium
8	Growth Profile	Contracting
9	Industry	Heating/ventilating
10	Market Type	Slow growing, previously fast growth market
11	Licences (in/out)	IN
12	Number of Licences	1
13	Licensed Products	High volume mechanical ventilator
14	'Boston' Classification for Licensed Products	Cash Cow
15	Policy Objectives of the Company	To survive through reduction in size and costs, and overcoming recession related problems.
16	Company Product Profile	Major product line mature, scarcely profitable. Poor new product development. - Code M
17	Technology and New Product Strategy	To purchase technology rather than develop it 'in house' because of high costs of R & D. To introduce new products to maintain market position rather than in a competitive manner. - Code H
18	Initial Use of Licensing	Proactive
19	Licensing as Part of Company Strategy	Following initial ad hoc use, always considered but in a very reactive manner. - Code A
20	Process of Licensing	Costly process which took longer than anticipated led to problems for firm. Not enough leadership from top management. Licensing was therefore relatively unsuccessful due to poor planning.

COMPANY H*

1	Company Type	Small subsidiary. Recent loss of direction due to technological change
2	Ownership	Subsidiary
3	Size (employees)	200
4	Age (years)	53
5	Classification	Non specialised - product oriented
6	Management Type	Centralised
7	Competition	High
8	Growth Profile	Contracting
9	Industry	Instrument engineering. Domestic and industrial controls
10	Market Type	Market in recession. Highly competitive and difficult market.
11	Licences (in/out)	IN
12	Number of Licences	1 (under negotiation)
13	Licensed Products	None so far
14	'Boston' Classification for Licensed Products	Research and Development
15	Policy Objectives of the Company	To survive, having heavily rationalised in recent past.
16	Company Product Profile	Range of mature products not generating sufficient income for investment. - Code M
17	Technology and New Product Strategy	Low rate of technical change in company led to requirement to update existing product line. Strategy to obtain replacement products as quickly as possible. - Code H
18	Initial Use Of Licensing	Reactive
19	Licensing as Part of Company Strategy	Considered as a method of augmenting internal skills but in reaction rather than as planned strategy. - Code A
20	Process of Licensing	Several products evaluated on ongoing basis. Transfer of technology difficult to fit in with present structure. Licensing unsuccessful to date due to internal constraints and poor planning.

COMPANY K*

1	Company Type	Old family firm until taken over by holding group
2	Ownership	Subsidiary
3	Size (employees)	95
4	Age (years)	123
5	Classification	Specialised - diversifying
6	Management Type	Autocratic
7	Competition	High
8	Growth Profile	Contracting
9	Industry	Mechanical engineering - hydraulic presses
10	Market Type	Market characterised by large numbers of specialist producers
11	Licences (in/out)	IN
12	Number of Licences	2
13	Licensed Products	Small powder metal and concrete hydraulic presses
14	'Boston Classification for Licensed Products	Problem
15	Policy Objectives of the Company	Survival following continual process of reduction over ten years
16	Company Product Profile	One off large 'designer' presses. New ranges of smaller presses being developed. - Code M
17	Technology and New Product Strategy	To retain its heavy engineering skills in time of recession while building up alternative light engineering products. - Code H
18	Initial Use of Licensing	Reactive
19	Licensing as Part of Company Strategy	Considered reactively as means of overcoming gap in product portfolio. - Code I
20	Process of Licensing	Active search in the UK for products being outlicensed from rationalising companies and abroad for new press technology.

COMPANY L*

1	Company Type	Small subsidiary company but with large amount of autonomy
2	Ownership	Subsidiary
3	Size (employees)	112
4	Age (years)	34
5	Classification	Non specialised - product oriented
6	Management Type	Participatory
7	Competition	Medium
8	Growth Profile	Expanding
9	Industry	Electronics - defence related
10	Market Type	Insecure due to vagaries of ministry purchasing policy
11	Licences (in/out)	IN (none yet finalised)
12	Number of Licences	0
13	Licensed Products	-
14	'Boston' Classification for Licensed Products	Research and Development
15	Policy Objectives of the Company	To diversify away from present product lines and customers to make company more robust.
16	Company Product Profile	Highly profitable product range but too dependent upon one major customer. - Code B
17	Technology and New Product Strategy	To become market leaders in particular technological niches through the introduction of new products. To develop and obtain new technologies to attack new markets. - Code H
18	Initial Use of Licensing	Proactive
19	Licensing as Part of Company Strategy	Always considered as method of augmenting 'in house' skills. - Code A
20	Process of Licensing	Through in house search utilising untrained personnel. This process unsuccessful to date due to internal resistance to accepting technology.

COMPANY M

1	Company Type	Small, fast growth, entrepreneurial
2	Ownership	Owner managed
3	Size (employees)	30
4	Age (years)	9
5	Classification	Non specialised - market oriented
6	Management Type	Autocratic
7	Competition	Medium
8	Growth Profile	Expanding
9	Industry	Electronics - control and measuring equipment
10	Market Type	Growing, as increased numbers of applications for measuring technology developed
11	Licences (in/out)	IN
12	Number of Licences	3
13	Licensed Products	Vehicle Logger, Flowmeter Vehicle Classifier
14	'Boston Classification for Licensed Products	All 'stars'
15	Policy Objectives of the Company	To grow as fast as possible while diversifying into new market areas and new products to service existing markets.
16	Company Product Profile	Very well balanced portfolio of highly profitable and high potential products - Code B
17	Technology and New Product Strategy	To retain market leadership in present market areas and to obtain new technologies allowing the development of new products as quickly as 'in house' skills allow, while also exploiting outside assistance. - Code H
18	Initial Use of Licensing	Reactive
19	Licensing as Part of Company Strategy	Licensing as the major core of the company's strategy for new products in new areas, and to augment 'in house' skills. - Code A
20	Process of Licensing	Close links with technology suppliers leading to opportunities arising frequently. Generally successful use of licensing as providing a pool of new technologies particularly from government funded labs.

COMPANY N

1	Company Type	Previously old established family concern - now part of group
2	Ownership	Subsidiary
3	Size (employees)	208
4	Age (years)	55
5	Classification	Specialised - non-diversifying
6	Management Type	Autocractic
7	Competition	Low
8	Growth Profile	Contracting
9	Industry	Mechanical Engineering - 'HEVAC'
10	Market Type	Previously fast growth, currently static due to recession
11	Licences (in/out)	OUT
12	Number of Licences	20
13	Licensed Products	Range of 'HEVAC' designs
14	'Boston ' Classification for Licensed Products	Cash cows and stars
15	Policy Objective of the Company	To move, in the long term, out of manufacturing and to act as a contract R & D company
16	Company Product Profile	Extensive range of market leader designs. Balance of manufacturing and R & D changing. - Code M
17	Technology and New Product Strategy	To generate income through the exploitation of company technology by sale of goods in home markets and sale of technology abroad. Continuing high R & D expenditures, to produce new products/technologies. - Code P
18	Initial Use of Licensing	Reactive
19	Licensing as Part of Company Strategy	Outward licensing used to exploit technology in foreign markets. The major method of obtaining a return in these markets. - Code A
20	Process of Licensing	Choice of medium sized, fast growth companies, not necessarily market leaders, to exploit the market.

COMPANY O *

1	Company Type	One product company exploiting small market niche
2	Ownership	Owner managed
3	Size (employees)	50
4	Age (years)	15
5	Classification	Specialised - non-diversifying
6	Management Type	Participatory
7	Competition	Low
8	Growth Profile	Expanding
9	Industry	Mechanical engineering - automotive/ castings
10	Market Type	Fast growth through growth in international markets
11	Licences (in/out)	OUT
12	Number of Licences	18
13	Licensed Products	Casting and sealing process
14	'Boston Classification for Licensed Products	Cash Cows
15	Policy Objectives of the Company	To obtain worldwide coverage for product by entry into new markets
16	Company Product Profile	One product, market leader in its field. Profitable. - Code N
17	Technology and New Product Strategy	To exploit their technology through the sale of know-how and the development of processes to use that technology. Technology development of new products funded by the old. - Code P
18	Initial Use of Licensing	Proactive
19	Licensing as Part of Company Strategy	Outward licensing used as sole method of marketing abroad. Licensing in UK by geographical area. - Code A
29	Process of Licensing	Sale of technology to companies. Profit made on supply of parts and materials for process.

COMPANY P

1	Company Type	Partnership set up 15 years ago to exploit new technology
2	Ownership	Owner manager
3	Size (employees)	53
4	Age (years)	18
5	Classification	Specialised - non-diversifying
6	Management Type	Autocratic
7	Competition	Medium
8	Growth Profile	Expanding
9	Industry	Mechanical engineering - electrostatic coating equipment
10	Market Type	Fast growing as applications for spray coating substitute for paint and other coatings
11	Licences (in/out)	OUT
12	Number of Licneces	6
13	Licensed Products	Electrostatic powder coating machinery
14	'Boston' Classification for Licensed Products	Stars
15	Policy Objectives of the Company	To maintain growth speed by retaining market leadership in current market segment
16	Company Product Profile	Full market coverage of electrostatic coating equipment. Profitable product lines. - Code N
17	Technology and New Product Strategy	Incremental development of technology such that competitors would always be behind. Fast pace of technical change allows development of new products and into new markets on ongoing basis. - Code H
18	Initial Use of Licensing	Reactive
19	Licensing as Part of Company Strategy	Used where other methods of market realisation not possible due to tariff or other barriers or lack of resources. - Code A
29	Process of Licensing	Licences granted on a strictly geographical basis to fast growth small firms. Income from licensing ploughed back into R & D.

COMPANY R *

1	Company Type	Old established traditional family company
2	Ownership	Owner manager
3	Size (employees)	42
4	Age (years)	75
5	Classification	Specialised - non-diversifying
6	Management Type	Autocratic
7	Competition	High
8	Growth Profile	Contracting
9	Industry	Boat building. Design and build facility
10	Market Type	Traditional market, currently very competitive. Low profit margins
11	Licences (in/out)	OUT
12	Number of Licences	None at time of case
13	Licensed Products	Boats (none to date)
14	'Boston' Classification for Licensed Products	Cash cow
15	Policy Objectives of the Company	To grow through the development of new products and new markets
16	Company Product Profile	All product lines in depressed market. Barely profitable - Code M
17	Technology and New Product Strategy	The utilisation of new designs and techniques to develop out of previous one-off boat designs and into a batch process product which could also be exported or sold under licence agreements. - Code P
18	Initial Use of Licensing	Reactive
19	Licensing as Part of Company Strategy	Intended to be important market strategy but generally failed due to lack of resources to exploit product, and economic conditions. - Code N
20	Process of Licensing	Choice of local licensees restricted by skill availability in third world markets, leading to lack of direction and eventual failure in licence agreements.

COMPANY S *

1	Company Type	Large design consultancy partnership
2	Ownership	Owner managed
3	Size (employees)	63
4	Age (years)	18
5	Classification	Non specialised - product oriented
6	Management Type	Autocratic
7	Competition	High
8	Growth Profile	Expanding
9	Industry	Design/consulting engineers
10	Market Type	Market characterised by large numbers of small competitors - Growing
11	Licences (in/out)	OUT
12	Number of Licences	1
13	Licensed Products	Registered designs and patents for oxygen mask
14	'Boston' Classification for Licensed Products	Research and Development
15	Policy Objectives of the Company	To become the largest UK design consultancy and to diversify into new product development
16	Company Product Profile	Product comprised series of designs for innovative defence product. - Code B
17	Technology and New Product Strategy	Technological developments usually carried out for particular clients. Hence technology and new products are clients' property. However, in some cases overseas rights obtained by Company S . - Code D
18	Initial use of Licensing	Proactive
19	Licensing as Part of Company Strategy	Licensing used on 'one-off' basis to exploit a particular product. Does not form part of general company strategy. - Code I
20	Process of Licensing	Attempt to license to market leader failed, hence further negotiations with smaller, more entrepreneurial company.

COMPANY T *

1	Company Type	Recent management buy-out
2	Ownership	Owner managed
3	Size (employees)	152
4	Age (years)	26 (in previous form)
5	Classification	Specialised - non-diversifying
6	Management Type	Centralised
7	Competition	Medium
8	Growth Profile	Static
9	Industry	Electronics - Rare earth magnets
10	Market Type	Market characterised by high specialisation in small market segments
11	Licences (in/out)	OUT
12	Number of Licences	17
13	Licensed Products	Rare earth magnets
14	'Boston' Classification for Licensed Products	Stars and Cash Cows
15	Policy Objectives of the Company	To exploit monopoly position in the UK market and to attack foreign competitors on their home territory.
16	Company Product Profile	Highly profitable specialist products. Good balance current products:new development. - Code B
17	Technology & New Product Strategy	To develop 'in house' expertise to the greatest possible extent in developing new products by seeking out and exploiting new technologies within and from outside the firm. - Code H
18	Initial Use of Licensing	Proactive
19	Licensing as Part of Company Strategy	Outward licensing to those markets where normal exporting is not possible because of tariff or other barriers. - Code A
20	Process of Licensing	Cross licensing, particularly of outmoded products has been very important to the company.

COMPANY U *

1	Company Type	Small unit of large conglomerate company
2	Ownership	Subsidiary
3	Size (employees)	108
4	Age (years)	130
5	Classification	Non specialised - product oriented
6	Management Type	Participatory
7	Competition	High
8	Growth Profile	Expanding
9	Industry	Plastics - containers for food, etc
10	Market Type	Highly competitive market characterised by small market niches - large and small producers in market
11	Licences (in/out)	OUT
12	Number of Licences	1
13	Licenced Products	Plastic pack production process
14	'Boston' Classification for Licensed Products	Stars
15	Policy Objectives of the Company	To develop existing skills and increase strengths within main market
16	Company Product Profile	Full range of plastic containers. Strength lies in process skills within the company. - Code M
17	Technology and New Product Strategy	To develop new technological strengths but using current core skills. - Code D
18	Initial Use of Licensing	Reactive
19	Licensing as Part of Company Strategy	To optimise return on technology developed 'in house' by entering new and foreign markets. - Code I
20	Process of Licensing	Approach to potential partners in the UK and overseas with view to joint exploitation

COMPANY V *

1	Company Type	Old established family firm. Currently part of group
2	Ownership	Subsidiary
3	Size (employees)	208
4	Age (years)	60
5	Classification	Specialised - non-diversifying
6	Management Type	Autocratic
7	Competition	Low
8	Growth Profile	Static
9	Industry	Textiles - specialist labels
10	Market Type	Competition from other technologies in market. Small but profitable market
11	Licences (in/out)	OUT
12	Number of Licences	1
13	Licensed Products	Weaving process (none to date)
14	'Boston' Classification for Licensed Products	Cash cow
15	Policy Objectives of the Company	To survive in an increasingly competitive environment through modernisation not expansion
16	Company Product Profile	One product company based upon monopoly of particular weaving process. - Code M
17	Technology and new Product Strategy	To develop new production technology - Code D
18	Initial Use of Licensing	Reactive
19	Licensing as Part of Company Strategy	Very ad hoc use of licensing. Reactive and passive rather than proactive. -Code I
20	Process of Licensing	Response to approaches from potential licensees. Very poorly co-ordinated.

COMPANY W

1	Company Type	Small job shop 'metal bashing' company
2	Ownership	Private - not owner managed
3	Size (employees)	140
4	Age (years)	28
5	Classification	Non specialised - metal oriented
6	Management Type	Participatory
7	Competition	Medium
8	Growth Profile	Static
9	Industry	Metal goods - steel cabinets
10	Market Type	Traditional skill based market
11	Licences (in/out)	OUT
12	Number of Licences	1
13	Licensed Products	Metal cabinet design
14	'Boston ' Classification for Licensed Products	Cash cow
15	Policy Objectives of the Company	To survive the recession and to become more competitive, ready to expand when recession ends
16	Company Product Profile	Low technology, skill intensive products, commissioned not mass produced - Code M
17	Technology and New Product Strategt	Low technology industry, relies very much on skills of operatives. Strategy of company is to develop these skills and to utilise registered designs to compete. - Code D
18	Initial Use of Licensing	Reactive
19	Licensing as part of Company Strategy	Licensing of a particular design to a European company. Licensing not a major part of company strategy but an ad hoc process. - Code N
20	Process of Licensing	Cross licensing agreements

COMPANY X *

1	Company Type	Research intensive and skill intensive company
2	Ownership	Owner managed
3	Size (employees)	12
4	Age (years)	10
5	Classification	Specialised - non-diversifying
6	Management Type	Participatory
7	Competition	Low
8	Growth Profile	Expanding
9	Industry	Plastics. Plastic product for construction industry
10	Market Type	GRP market characterised by large number of small companies in small niches
11	Licences (in/out)	OUT
12	Number of Licences	4
13	Licensed Products	Glass fibre moulding/spinning process
14	'Boston' Classification for Licensed Products	Star
15	Policy Objectives of the Company	To remain at a small size but to expand turnover, to give directors capital gains
16	Company Product Profile	Product highly skill intensive. Market leader, highly profitable 'star' product. - Code N
17	Technology and New Product Strategy	To develop and exploit new technology through sale of patents and know-how. To utilise cash flows resulting from these operations. To develop new innovative GRP products. - Code P
18	Initial Use of Licensing	Reactive
19	Licensing as Part of Company Strategy	Licensing utilised to generate cash flows - Code A
20	Process of Licensing	Licensing to one company in a particular market with good links to utility buyers.

COMPANY AA

1	Company Type	Previously family owned. Now group owned market leader
2	Ownership	Subsidiary
3	Size (employees)	370
4	Age (years)	225
5	Classification	Specialised - diversifying
6	Management Type	Autocratic
7	Competition	Medium
8	Growth Profile	Expanding
9	Industry	Mechanical engineering - springs
10	Market Type	Market characterised by high competition in cheap substitutes. Low competition in high quality products.
11	Licences (in/out)	IN & OUT
12	Number of Licences	4
13	Licensed Products	Inward licensing of metal circlip technology. Outward licensing of process technology
14	'Boston' Classification for Licensed Products	Product 1 - Star Product 2 - Research & Development
15	Policy Objectives of the Company	Controlled growth through incremental development of current products strengths
16	Company Product Profile	High volume 'medium technology' springs Low volume 'high technology' springs - Code B
17	Technology and New Product Strategy	To build on 'in house' strengths to develop new products utilising inward and outward licensing as appropriate. - Code H
18	Initial Use of Licensing	Proactive
19	Licensing as Part Of Company Strategy	Always considered as part of new product development and exploitation process. - Code I
20	Process of Licensing	Long term licence agreement with initial licensor

COMPANY BA

1	Company Type	Company set up as supplier of materials to group
2	Ownership	Subsidiary
3	Size (employees)	400
4	Age (years)	37
5	Classification	Non specialised - product oriented
6	Management Type	Centralised
7	Competition	Medium
8	Growth Profile	Expanding
9	Industry	Chemicals/plastics. - PVC supplier - sheeting etc.
10	Market Type	Market subject to large price and volume fluctuations due to oil price changes and recession.
11	Licences (in/out)	IN & OUT
12	Number of Licences	52
13	Licensed Products	PVC conversion process licensed 'in' PVC base technology licensed 'out'
14	'Boston' Classification for Licensed Products	Product 1 - Research and Development Product 2 - Research and Development
15	Policy Objectives of the Company	To survive in market where falling sales have increased levels of competition
16	Company Product Profile	Mature product in main market provides resources to fund new developments - Code M
17	Technology and New Product Strategy	To utilise technology developed by others and 'in house' to compete in mass markets. To develop its own technology and products for exploitation. - Code H
18	Initial Use of Licensing	Proactive
19	Licensing as Part of Company Strategy	To license technology 'out' to those markets where tariffs preclude direct sale. To license technology 'in' where this gives competitive advantage. - Code A
20	Process of Licensing	Licensees are smaller firms in foreign markets. Many of those deals have led to joint ventures or inward investment by the licensee company.

COMPANY CA

1	Company Type	Company recently bought out by management
2	Ownership	Owner managed
3	Size (employees)	148
4	Age (years)	21
5	Classification	Specialised - diversifying
6	Management Type	Participatory
7	Competition	High
8	Growth Profile	Contracting
9	Industry	Electronics - answering machines
10	Market Type	Market characterised by increasing competition from foreign manufacturers
11	Licences (in/out)	IN & OUT
12	Number of Licences	4
13	Licensed Products	Inward and outward licensing of answering machines
14	'Boston' Classification for Licensed Products	Cash cows
15	Policy Objectives of the Company	To survive in increasingly competitive environment. To develop new products to augment declining product range
16	Company Product Profile	Dependent upon one mature product threatened by technological advances - Code M
17	Technology and New Product Strategy	To utilise technology developed 'in house' and from other sources to quickly develop new products. To reduce overheads by becoming less labour intensive through adoption of new technology. - Code H
18	Initial Use of Licensing	Reactive
19	Licensing as Part of Company Strategy	Purchase of technology to augment product range. Sale of technology to other quasi independent companies. - Code A
20	Process of Licensing	Generally successful but utilised in an *ad hoc* manner and hence rather unprofessional

COMPANY DA

1	Company Type	Small, low technology toy company
2	Ownership	Subsidiary of small group
3	Size (employees)	153
4	Age (years)	55
5	Classification	Non specialised - market oriented
6	Management Type	Autocratic
7	Competition	High
8	Growth Profile	Static
9	Industry	Toys
10	Market Type	Market characterised by short product life cycles and 'fashion' products
11	Licences (in/out)	IN & OUT
12	Number of Licences	Large number
13	Licensed Products	Inward and outward licensing of toy designs
14	'Boston' Classifaction for Licensed Products	Cash cows
15	Policy Objectives of the Company	To survive against increasingly strong competition from Asian suppliers
16	Company Product Profile	Range of low technology, high profit market oriented products. Very short life cycles. - Code B
17	Technology and New Product Strategy	To develop innovative new products quickly enough to take advantage of seasonal changes in the market. To devote resources to R & D to develop these new products. - Code H
18	Initial Use of Licensing	Proactive
19	Licensing as Part of Company Strategy	Inward and Outward licensing of low technology products as integral part of company strategy. - Code A
20	Process of Licensing	Licensing normal in industry through cross licensing agreements with foreign firms

COMPANY EA

1	Company Type	Small, diversified company - service based
2	Ownership	Private, not owner managed
3	Size (employees)	118
4	Age (years)	23
5	Classification	Non specialised - market oriented
6	Management Type	Participatory
7	Competition	Low
8	Growth Profile	Static
9	Industry	Mechanical engineering - provision of tools/equipment to construction industry
10	Market Type	Market characterised by small market niches and low competition
11	Licences (in/out)	IN & OUT
12	Number of Licences	5
13	Licensed Products	Inward - gas dectector Outward - security products
14	'Boston' Classification for Licensed Products	Inward - Research and Development Outward - Cash Cows
15	Policy Objectives of Company	To continue to expand its activities for utilities
16	Company Product Profile	Range of low technology, low profitability products. - Code M
17	Technology and New Product Strategy	Not to become involved in high technology but to develop a range of medium tech products based on utility specification. - Code H
18	Initial Use of Licensing	Reactive
19	Licensing as part of Company Strategy	Purchase of rights from the MoD as part of an ongoing relationship with that body. - Code I
20	Process of Licensing	Technology licensed both in and out, but only as peripheral activity

COMPANY FA *

1	Company Type	Medium sized engineering company
2	Ownership	Subsidiary
3	Size (employees)	900
4	Age (years)	16
5	Classification	Specialised - non-diversifying
6	Management Type	Autocratic
7	Competition	Medium
8	Growth Profile	Static
9	Industry	Metals - tube manufacturers
10	Market Type	Market characterised by high skill level of producers. Small niche, but growing
11	Licences (in/out)	IN & OUT
12	Number of Licences	12
13	Licensed Products	Inward and outward licensing of Coated Tube Technology
14	'Boston' Classification for Licensed Products	Research and Development
15	Policy Objectives of the Company	To consolidate its position in its own market sector by a degree of concentric diversification
16	Company Product Profile	High technology tube coating process market leader but requires investment Code N
17	Technology and New Product Strategy	To spend a high proportion of its turnover (in industry terms) on R & D to develop and improve its products. To obtain through 'in house' or external sources, technology allowing it to increase turnover in similar market segments. - Code H
18	Initial Use of Licensing	Reactive
19	Licensing as Part of Company Strategy	Licensing used as an integral part of company strategy obtaining developing and selling technology. - Code A
20	Process of Licensing	Purchase and Sale of technology from companies in markets distant enough not to be a threat to Company FA.

COMPANY GA

1	Company Type	Old established small engineering and chemical company
2	Ownership	Private, not owner managed
3	Size (employees)	147
4	Age (years)	56
5	Classification	Non specialised - market oriented
6	Management Type	Participatory
7	Competition	Medium
8	Growth Profile	Expanding
9	Industry	Chemicals - provision of special processes
10	Market Type	Small market sectors. Diverse type
11	Licences (in/out)	IN & OUT
12	Number of Licences	Large number
13	Licensed Products	Inward - rust proofing process Outward - Speciality chemicals
14	'Boston ' Classification for Licensed Products	Cash Cows
15	Policy objectives of the Company	To survive recession related reduction in business. To diversify into new areas.
16	Company Product Profile	Speciality chemicals and processes for their use. Highly profitable products supporting R & D - Code B
17	Technology and New Product Strategy	To incrementally improve present range of products and processes by purchase of technology. To utilise its own technology to develop into new markets. - Code P
18	Initial Use of Licensing	Reactive
19	Licensing as Part of Company Strategy	Highly proactive and strategic use of licensing both 'in' and 'out' - Code A
20	Process of Licensing	Cross licensing with firms in other (non competitive) markets

COMPANY HA *

1	Company Type	Medium sized engineering company
2	Ownership	Subsidiary
3	Size (employees)	530
4	Age (years)	Unknown
5	Classification	Specialised - non diversifying
6	Management Type	Centralised
7	Competition	Medium
8	Growth Profile	Expanding
9	Industry	Fasteners in steel and aluminium
10	Market Type	Fastener industry broken into small sectors
11	Licences (in/out)	IN & OUT
12	Number of Licences	3
13	Licensed Products	Inward and outward licensing of fastener technology
14	'Boston' Classification for Licensed Products	Stars
15	Policy Objectives of the Company	To generate high profits to subsidise other loss making companies in the group
16	Company Product Profile	Mature products providing high return. Low investment in new product development. - Code M
17	Technology and New Product Strategy	To obtain new technology and new markets as quickly as possible through purchase of expertise, rather than 'in house' R & D. - Code H
18	Initial Use of Licensing	Reactive
19	Licensing as Part of Company Strategy	Both inward and outward licensing utilised, to develop new products and markets, where direct export not possible. - Code A
20	Process of Licensing	Outward licensing to state organisations in Eastern Europe

COMPANY JA

1	Company Type	Small, fast growth Research and Development company
2	Ownership	Owner manager
3	Size (employees)	35
4	Age (years)	8
5	Classification	Non specialised - market oriented
6	Management Type	Participatory
7	Competition	High
8	Growth Profile	Expanding
9	Industry	Research/Development mechanical and electrical engineering
10	Market Type	Research market not very competitive. Product niche highly competitive
11	Licences (in/out)	IN & OUT
12	Number of Licences	3
13	Licensed Products	Licensing 'in' and 'out' of robot technology
14	'Boston' Classification for Licensed Products	Inward - Research and Development Outward - Star
15	Policy Objectives of the Company	To grow through development of own 'in house' products and expansion of R & D activities.
16	Company Product Profile	Mainly contract research, moving into manufacture of high tech 'star' products. - Code N
17	Technology and New Product Strategy	To obtain or develop new technology of a highly innovative type which could be manufactured or licensed 'out' - Code H
18	Initial Use of Licensing	Proactive
19	Licensing as Part of Company Strategy	Licensing both in and out to maximise scarce resources within the firm. - Code I
20	Process of Licensing	Licensing 'in' from Universities, development and licensing 'out' to industrial companies.

COMPANY KA *

1	Company Type	Old established small subsidiary
2	Ownership	Subsidiary
3	Size (employees)	106
4	Age (years)	37
5	Classification	Specialised - non diversifying
6	Management Type	Centralised
7	Competition	High
8	Growth Profile	Static
9	Industry	Chemicals - speciality inks
10	Market Type	Major market is other companies in parent group. No transfer pricing advantages however
11	Licences (in/out)	IN & OUT
12	Number of Licences	4
13	Licensed Products	Licensing 'in' and 'out' of speciality chemicals
14	'Boston' Classification for Licensed Products	Stars
15	Policy Objectives of the Company	To provide a service for the parent company, but to reduce dependence on this as a major market
16	Company Product Profile	Range of mature and developing products. Balanced portfolio of products. - Code B
17	Technology and New Product Strategy	To spend large amounts on R & D and to obtain technology where available to develop stream of new products. To become more R & D intensive and act as a research company. - Code H
18	Initial Use of Licensing	Proactive
19	Licensing as Part of Company Strategy	Highly proactive use of both inward and outward licensing. Cross licensing with overseas competitors. - Code A
20	Process of Licensing	Search for new technologies and partners on an ongoing basis, particularly in the USA.

COMPANY LA

1	Company Type	Small, old established, 'traditional' company
2	Ownership	Owner managed
3	Size (employees)	200
4	Age (years)	25
5	Classification	Specialised - diversifying
6	Management Type	Autocratic
7	Competition	Medium
8	Growth Profile	Expanding
9	Industry	Electronics - telecommunications switches
10	Market Type	Fast changing due to technological progress
11	Licences (in/out)	IN
12	Number of Licences	3
13	Licensed Products	Inward licensing of telecommunications products to service major customer
14	'Boston' Classification for Licensed Products	Cash cows
15	Policy Objectives of the Company	To survive and regain former stability
16	Company Product Profile	Mix of traditional, obsolescent electro-mechanical products and newly acquired electronic products. - Code M
17	Technology and New Product Strategy	To replace outdated product portfolio with new product range. - Code H
18	Initial Use of Licensing	Reactive
19	Licensing as Part of Company Strategy	Central part of survival strategy to obtain new products - Code I
20	Process of Licensing	Highly proactive, survival induced.

COMPANY MA

1	Company Type	Small, fast growth, computing company. Service based
2	Ownership	Owner managed
3	Size (employees)	18
4	Age (years)	7
5	Classification	Non specialised - market oriented
6	Management Type	Participatory
7	Competition	Medium
8	Growth Profile	Expanding
9	Industry	Electronics/computing
10	Market Type	Fast expanding markets
11	Licences (in/out)	IN
12	Number of Licences	1
13	Licensed Products	Inward licensing of educational hardware and software product
14	'Boston' Classification for Licensed Products	Cash cows
15	Policy Objectives of the Company	To grow, through product acquisition.
16	Company Product Profile	Service based, currently exclusively concerned with mainframe computer maintenance. - Code N
17	Technology and New Product Strategy	To develop existing skills but to build on these skills to diversify and enter new markets. - Code P
18	Initial Use of Licensing	Reactive
19	Licensing as Part of Company Strategy	Central part of change from service to manufacture via agency/franchise/ licence agreements. - Code A
20	Process of Licensing	Proactive use of licensing through contacts in the United States.

COMPANY NA

1	Company Type	Fast growth, profit maximising small company
2	Ownership	Subsidiary
3	Size (employees)	200
4	Age (years)	50
5	Classification	Specialised - diversifying
6	Management Type	Autocratic
7	Competition	High
8	Growth Profile	Expanding
9	Industry	Vehicle components
10	Market Type	Market subject to large fluctuations in order levels
11	Licences (in/out)	OUT
12	Number of Licences	5
13	Licensed Products	Outward licensing of seat tilting mechanism
14	'Boston' Classification for Licensed Products	Star
15	Policy Objectives of the Company	To improve 'quality' image, to diversify into new markets.
16	Company Product Profile	Range of components and sub-assemblies for cars - Code B
17	Technology and New Product Strategy	To develop new products 'in house'. To acquire new products through collaboration with customers. To exploit its technology abroad - Code H
18	Initial Use of Licensing	Reactive
19	Licensing as Part of Company Strategy	Central part of strategy for exploitation of one major product line. - Code I
20	Process of Licensing	Licensing in reaction to export barriers

COMPANY PA

1	Company Type	Very diversified traditional West Midlands 'metal basher'
2	Ownership	Private - not owner managed
3	Size (employees)	180
4	Age (years)	200
5	Classification	Non specialised -market oriented
6	Management Type	Participatory
7	Competition	High
8	Growth Profile	Expanding
9	Industry	Metal products
10	Market Type	Markets very diversified, range of types and characteristics
11	Licences (in/out)	IN
12	Number of Licences	1
13	Licensed Products	Inward licensing of caravan accessory designs
14	'Boston' Classification for Licensed Products	Star
15	Policy Objectives of the Company	To increase turnover through acquisition of companies and products to fully utilise manufacturing capacity
16	Company Product Profile	Very diversified - motor accessories - commercial vehicle fittings - metal pallets - caravan luxury hampers - Code B
17	Technology and New Product Strategy	To obtain new products through acquisition of design. - Code P
18	Initial Use of Licensing	Reactive
19	Licensing as Part of Company Strategy	Proactive/reactive strategy to encourage others to approach the company with technology to offer Code A
20	Process of Licensing	Licensing of 'low level' technology in the form of design protected products

COMPANY QA

1	Company Type	Independent design and R & D company
2	Ownership	Owner managed
3	Size (employees)	40
4	Age (years)	36
5	Classification	Specialised - non-diversifying
6	Management Type	Autocratic
7	Competition	Low
8	Growth Profile	Expanding
9	Industry	Mechanical engineering - printing machinery
10	Market Type	Industry characterised by many 'local' suppliers
11	Licences (in/out)	OUT
12	Number of Licences	30
13	Licensed Products	Outward licensing of process technology for printing industry
14	'Boston' Classification for Licensed Products	Cash cows
15	Policy Objectives of the Company	To maintain and build upon current technology leadership. To remain small scale
16	Company Product Profile	Mainly licensing out of one process and associated machinery - Code N
17	Technology and New Product Strategy	To incrementally improve, and patent, current technology - Code P
18	Initial Use of Licensing	Reactive
19	Licensing as Part of Company Strategy	Highly proactive, the central core of company product strategy - Code A
20	Process of Licensing	Licensing 'out' to numerous users of process technology

COMPANY RA

1	Company Type	Small, traditional Black Country metal working
2	Ownership	Owner managed
3	Size (employees)	160
4	Age (years)	107
5	Classification	Non specialised - market oriented
6	Management Type	Autocratic
7	Competition	High
8	Growth Profile	Static
9	Industry	Metal working/mechanical engineering
10	Market Type	Markets characterised by high levels of competition until recession reduced such pressures through closures
11	Licences (in/out)	IN
12	Number of Licences	2
13	Licensed Products	Inward licensing of patented racking and security products
14	'Boston' Classification for Licensed Products	Stars
15	Policy Objectives of the Company	To survive, to obtain further products to increase turnover to cover overheads
16	Company Product Profile	Range of mainly traditional products. Few 'new' technology substitutes. - Code M
17	Technology and New Product Strategy	To obtain new products through purchase and 'in house' development to utilise existing capacity better. - Code H
18	Initial Use of Licensing	Reactive
19	Licensing as Part of Company Strategy	Reactive but opportunistic. Licensing seen as one small strand of new product strategy - Code A
20	Process of Licensing	Inward licensing from overseas companies and UK Research Establishments

COMPANY SA

1	Company Type	Old established, 'progressive' family run firm
2	Ownership	Owner manager
3	Size (employees)	108
4	Age (years)	209
5	Classification	Non specialised - product oriented
6	Management Type	Family (participatory)
7	Competition	Low
8	Growth Profile	Expanding
9	Industry	Diversified - metal tools, caravan accessories
10	Market Type	Stable, low growth market. Company is monopolist in major market sectors
11	Licences (in/out)	IN & OUT
12	Number of Licences	3
13	Licensed Products	Inward licensing of caravan heaters Outward licensing of steel clamps
14	'Boston' Classification for Licensed Products	Inward - Star Outward - Cash cow
15	Policy Objectives of the Company	To grow slowly, but under control and to diversify into new markets
16	Company Product Profile	Range of traditional cast steel clamps. Caravan accessories (heaters) for UK caravan market. - Code B
17	Technology and New Product Strategy	To identify new products for current markets. To utilise current products for attack on new markets. - Code D
18	Initial Use of Licensing	Proactive
19	Licensing as Part of Company Strategy	Previously proactive but currently in abeyance. Reactive in sense of considering new product ideas. - Code A
20	Process of Licensing	Licensing 'in' on ad hoc basis without recourse to professional assistance

COMPANY TA

1 Company Type	Fast growth company in traditional industry
2 Ownership	Subsidiary
3 Size (employees)	316
4 Age (years)	50
5 Classification	Specialised - diversifying
6 Management Type	Autocratic
7 Competition	High
8 Growth Profile	Expanding
9 Industry	Metal process plant and treatment
10 Market Type	Traditional markets currently subject to fast technological change
11 Licences (in/out)	IN
12 Number of Licences	2
13 Licensed Products	Inward licensing of chemical hardening process
14 'Boston' Classification for Licensed Products	Star
15 Policy Objectives of the Company	To grow to provide countrywide service network and to become market leader.
16 Company Product Profile	Large range of metal treatments, more than competitors. - Code B
17 Technology and New Product Strategy	To develop new treatments more effective and efficient than current technology. - Code H
18 Initial Use of Licensing	Reactive
19 Licensing as Part of Company Strategy	Proactive consideration of licensing in seeking new products. Code A
20 Process of Licensing	Carried out in a highly professional manner following in depth and long study

COMPANY UA

1	Company Type	Medium sized independent carpet company
2	Ownership	Private - not owner managed
3	Size (employees)	368
4	Age (years)	116
5	Classification	Specialised - non diversifying
6	Management Type	Participatory
7	Competition	High
8	Growth Profile	Expanding
9	Industry	Textiles
10	Market Type	Highly competitive generally, less so in particular niches
11	Licences (in/out)	IN
12	Number of Licences	3
13	Licensed Products	Inward licensing of carpet process and production technology
14	'Boston' Classification for Licensed Products	Stars
15	Policy Objectives of the Company	To maintain market leadership and to grow into other market segments
16	Company Product Profile	Company dependent on one major process for carpet production. Product sold into three major markets -Code B
17	Technology and New Product Strategy	Industry tends to be very skill intensive. Company has tried to reduce its dependence on such skills and to modernise production processes. - Code H
18	Initial Use of Licensing	Proactive
19	Licensing as Part of Company Strategy	Proactive in embodied technology which has then been further developed. - Code A
20	Process of Licensing	Licensing from American world technological leader

COMPANY VA

1	Company Type	Old established 'metal bashing' company subject of recent management buy-out
2	Ownership	Owner managed
3	Size (employees)	120
4	Age (years)	170
5	Classification	Non specialised - product oriented
6	Management Type	Participatory
7	Competition	High
8	Growth Profile	Expanding
9	Industry	Metal products
10	Market Type	High competition, low profit margin markets
11	Licences (in/out)	IN
12	Number of Licences	4
13	Licensed Products	Inward licensing of racking for electronic products and process technology for new materials
14	'Boston' Classification for Licensed Products	Stars
15	Policy Objectives of the Company	To build on existing profitability and diversify into new markets
16	Company Product Profile	Metal cabinets, plastic cabinets, small amount of electronic assembly - Code M
17	Technology and New Product Strategy	To obtain new process technology for the use of new materials. To obtain new products through acquisition Code P
18	Initial Use of Licensing	Proactive
19	Licensing as Part of Company Strategy	Proactive and successful search and integration of licensed products into portfolio. - Code A
20	Process of Licensing	Licensing from similar European companies and very different US companies

APPENDIX 6.6

SUCCESS AND FAILURE IN TECHNOLOGY IMPORT THROUGH LICENSING IN SMALLER FIRMS

by B Svensson (University of Linkoping)

The Success Cases:

Case No 1 Experienced businessman/technician generally interested in business options accepts when offered the licence rights of an established product. Establishes a new firm to exploit the acquired licence.

Case No 2 Internationally experienced managing director and owner of a recently established firm searches actively on the continent to find a solution to a customer need. In-house development is consciously avoided. Licensing is seen as an ideal complement to sub-contracting.

Case No 3 Partner of a firm engaged in sub-contracting travels in the US to find suitable product within the present field of competence. Obtains an agency which within three years is transformed into a licence.

Case No 4 New methods recently introduced on the market threaten one of the key products of the firm. High preparedness to new signals from the market. Unique method presented in an international magazine and at a fair,triggers off activity.

Case No 5 Owner of a small firm looks for alternatives to expand present business to be able to offer his children employment. Reacts to an advertisement through which a Danish firm seeks partner on the Swedish market.

Case No 6 New business concept introduced in sub-contracting firm by new managing director. Acquires licence through a previously established business relation in the US. The licensed product becomes core product in a turn-key systems.

Case No 7 Managing director of a small mechanical workshop with in-house developed products in the decline stages of their product life-cycles, starts looking for new products in the US to avoid too much dependence on sub-contracting. Responds to an advertisement in a trade magazine through which a US firm seeks licensee on the European market.

Cases Nos 8 - 9	Agencies converted into licence agreements due to high transportation costs.

The Failures

Case No 10	Managing director of a small firm contacts a MNC to get access to a new technology presented in a trade magazine. Intended field of use not accepted by the MNC. The MD accepts other fields of use unfamiliar to his firm.
Case No 11	Firm experienced in international licensing responds to an advertisement in a US trade magazine, where a new technology, applicable to the firm's current products, is offered.
Case No 12	Licensor offers managing director new, unproven technology to satisfy a well-known need on the current market.
Case No 13	Regional body connects community officials looking for a replacement industry with a Swedish firm seeking a firm interested in obtaining the manufacturing rights for a German product for which the Swedish firm holds the marketing rights. An entirely new production unit is built.

Cases under development, "on the market"

Case No 14	Consultant firm finds interesting technology by putting an advertisement in Wall Street Journal. "Marries" the US licensor with Swedish firm in need of new products.
Case No 15	Swedish firm oriented at expanding its present market turns to consultant firm to find new products.
Case No 16	Swedish bank acts as intermediary to connect a smaller firm of its clientele, heavily dependent on one big customer, with British firm looking for a partner on the Scandinavian market.

Cases under development, "not on the market"

Case No 17	Regional body connects managing director of a small firm with a Swedish consultant representing a US small firm that offers a unique, unproved technology.

Case No 18 — Former MD of a US subsidiary in Sweden establishes in cooperation with a sub-contracting firm, a new manufacturing firm to exploit an unproved technology obtained from an old business friend.

Case No 19 — Licence object is identified through screening of existing technical solutions within the firm's field of operation.

Case No 20 — A researcher draws his friend's, a managing director of a smaller firm, attention to a new technology within the firm's field of operation, presented at a symposium in Japan. The Japanese firm is contacted by letter.

Case No 21 — Facing a market threat a small agency firm searches for technology to become competitive as a manufacturer. Former employee of the commissioning firm assists in the identification and evaluation of the technology.

Case No 22 — New product area identified after reformulation of the business concept. German firm in possession of the desired product technology directly approached.

CHAPTER 7

CONCLUSIONS

CONCLUSIONS

A. INTRODUCTION

The major objective of this work has been an exploration of the role that technology licensing (TL) plays in the product and market diversification strategies of smaller firms. For simplicity, a modular approach to the study was adopted in the consideration of small firm policy making, diversification and the use of technology, leading to the empirical studies in Chapter 6 into TL *per se.* The conclusions are therefore presented as follows. First, the use of TL in diversification within a business policy context is reviewed in light of the results presented in the early chapters. Second, review is made of the success of adopting a case approach to the collection of data on TL. Third, the results and conclusions of the empirical work in Chapter 6 are reviewed in light of the hypotheses generated and tested there. Lastly, as a result of the conclusions reached, certain proposals for smaller firms considering the use of TL are put forward and suggestions for further work in the field are made. It is hoped that the thesis conclusions may provide a base for further work in this area.

B. REVIEW OF TECHNOLOGY LICENSING IN A BUSINESS POLICY CONTEXT

The integration of the different issues involved in the development of policy within smaller firms and the use of TL within strategies to fulfil those policies was explored in the early chapters of the thesis. The major objective of the work was in consideration of how TL was integrated by such firms into strategies to develop and diversify into new products and new markets. Initial aims were therefore to explore the formulation of policy in smaller firms, the diversification strategies of such firms, and the technological pressures and environments within which such strategies were carried out. This led to the modular approach of the work adopted in Chapters 2,3 and 4, where these issues were considered separately, providing a base for the empirical studies into TL described in Chapter 6. Specific research objectives were therefore identified as, identifying policy formulation processes in small firms; measuring the extent of diversification in such firms; investigating the ability of such firms to act flexibly in accepting new techniques such as TL and lastly, measuring the extent and success of the use of TL in small firms in practice, the major empirical part of the study.

It was a major conclusion within Chapter 2 that the formulation of policy within smaller firms usually took place as part of an implicit rather than an explicit process. This was clearly important in attempting to understand how the use of TL might be incorporated into such policies. Clearly, the use of TL can most appropriately be viewed as a business or operational strategy, rather than as part of the corporate level policy making process and offers only one alternative approach to the several different strategies that could be adopted by smaller firms in developing their technology portfolios and their markets. However, the studies in Chapter 2 also suggested that market entry by such firms may frequently arise outside any formal strategic context and owe more to expediency than to planning per se.

It was deemed important therefore, to attempt to classify smaller firms in terms of their approach to the practical formulation of policy objectives. Various classifications were proposed, including 'thrusters' and 'sleepers', those developing small niche or more broad based markets and those exploiting comparative or absolute advantage in their business strategies. However, if policy making is generally an implicit process in smallerfirms, identifying the mechanisms and level at which TL was incorporated into those policies could be problematical, in view of the large number of industries and technologies in which TL appeared to play a part. It was clear therefore, that in the context of this study, data collection was likely to be difficult. It was for this reason that a case approach to the main empirical work was adopted. The implications results and conclusions of adopting this approach are explored below.

If smaller firms can act flexibly as suggested in Chapter 2, it might be anticipated that diversification into new areas as a result of competition, growth or other pressures, might be facilitated by the use of TL, as a resource conservation process.

However, in the context of this study, defining 'diversification' led to problems of definition. Clearly, any development from current product lines or markets is a form of diversification,as the exploration of the work of Ansoff and other authors in Chapter 3 showed. A relatively restricted definition was adopted here, therefore, based on Ansoffian concepts as - development into entirely new products, or new geographical markets using existing products (for inward and outward TL respectively).

The results of the empirical studies in Chapter 3 led to the conclusion that many smaller firms did diversify into new areas, particularly in 100-200 employee size range with less diversification at both the smaller and larger size ranges. This is suggested to be an important conclusion in the context of this study, since it suggested that such firms were experimenting with new forms of business development, of which TL is clearly an important alternative. It might be anticipated however, that the use of TL in diversification of the sort described might be subject to barriers including cultural factors,a paucity of 'in-house' R & D facilities to amend licensed products for local markets and the 'Not Invented Here' syndrome. Conversely, TL might be promoted as a less risky method of market entry than other forms of development or because it allowed technical,financial or managerial thresholds to be overcome. However, previous workers in the field, and early case study evidence suggested that many smaller firms were using TL effectively and successfully in transferring technology both into and out of their companies across many industries. Collection of data on the use of TL by such firms, using the case study approach was therefore used, with the objective of defining the use of TL within small firm strategy, when and how it was used, and its success in practice as a business strategy.

C. CONCLUSIONS OF ADOPTING A CASE APPROACH

A major conclusion of Chapter 5 where the use of TL in all firms was reviewed, and previous case and other empirical work in this field, suggests that TL in general, and in smaller firms in particular, usually arises as a highly technological,situation and people specific process.[1] Methods of classifying such processes into a rational methodological framework were therefore required which would allow analysis to be made of numbers of small firm TL users across several industries, firm sizes and management structures. A case approach appeared to offer the most relevant method of obtaining data on licensing situations within smaller manufacturing firms and was therefore adopted for this and the following reasons. First, the major objective of the study was a consideration of the use of TL in a strategic sense. To this end, approach to those responsible for the strategic decision making processes within the sample firms was deemed important and the case study framework facilitated this method of data collection. Second, use of a case approach allowed for a manageable number of companies to be analysed 'in depth'. In view of the proposal in Chapter 6 that behavioural factors are particularly important in the use of TL, this was suggested to be crucial. Thirdly, it was a study objective to build upon the research carried out under the 'Leverhulme' project described above. That study encompassed a highly structured analytical approach to the

1. See Lowe J and Crawford N K. 'Innovation and Technology Transfer for the Growing Firm' op.cit.
The industries and technology types where TL appears to be particularly important are listed here.

use of TL by smaller firms. The approach adopted here was intended to complement that work through consideration of the strategic objectives of small company managements. It is considered that the approach adopted was generally successful in elucidating particular detail on the use of TL across several industries.

It is clear from the results of the case study analysis that a case approach is subject to both advantages and disadvantages. A major advantage of such an approach is that a somewhat less 'structured' format has to be used in obtaining information about the firm such that non standard information can be included. Endeavours to question case respondents on a structured basis were generally unsuccessful in obtaining all relevant information. A major benefit of talking to top company management lay in elucidating the firm's commitment to the licensing process. It was clear that many firms had considered but not utilised TL, where other, similar, firms had made use of it in similar situations. Another advantage of the 'case' approach lay in the extent of co-operation that was offered by many firms in furthering the course of the research. Provision of information on confidential details of agreements, royalty rates and other information was frequently obtained which, it is considered, would not have been obtained by, for example, a questionnaire study where no face to face interview had taken place.

However, it is also concluded that there are major disadvantages in adopting a case approach. In the time available, the number of firms upon whom 'in depth' case studies can be carried out is clearly limited. Forty case studies of the use of TL in small manufacturing firms were completed and this was considered to be the minimum number from which conclusions could realistically be made. Case respondents also clearly had 'their view' of how the use of TL had been adopted in their companies which conflicted to an extent with the views of others within the same company, in some cases.

As far as the case approach is concerned, therefore, it can be concluded that in elucidating behavioural and strategic decision making processes in small firms, this approach was a success in complementing the other empirical work carried out in the earlier chapters. Obtaining detail on the process and practice of TL within this strategic framework was, possibly, more problematical however.

D. TECHNOLOGY LICENSING AND BUSINESS STRATEGY IN SMALL FIRMS - CONCLUSIONS

1. The Use of TL as an Alternative Strategy

Although a main conclusion of Chapter 2 was that smaller firms can, in principle, act in a highly flexible manner in developing their new product and market strategies, few case firms appeared to do so in practice. Previous workers in the field of Business Policy have suggested that before the use of new techniques such as TL are incorporated into business strategies, a trigger signal, or incentive to change may be required. The implications of this were also discussed above. If the concept of classifying firms as 'thrusters' or 'sleepers'[1] or as 'parochial', 'progressive' or 'adaptive'[2] is considered valid, then the idea of a 'trigger' signal may be important in understanding the way the study sample of companies incorporated the use of TL within their businesses. TL generally appeared to be used in a very reactive manner, at least initially.

Other workers have suggested that growth is normally a major objective of organisations. Although many case companies cited growth as their principal policy objective it was clear from the case studies that prior to the use of TL many firms had been, and continued, to follow a satisficing role in small market niches where they had been operating for a considerable time, and in

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1. Political and Economic Planning, op.cit.

2. Carter, S F and Williams B R. op.cit

which conditions of competition were frequently low. It is pertinent to consider, therefore, first the number of firms which did in fact have growth as a major objective. Second, to define how such growth was managed within the firm and third, to identify how technology licensing had been used initially and was later integrated in these processes.

A majority of case companies stated that growth was a major objective and that they were in expanding markets. As far as outward licensing firms were concerned it was clear that many firms were utilising TL to overcome management time and other resource constraints to develop into new markets and achieve growth that might have been unattainable through other forms of market realisation. It seems clear that such firms could be classified as 'thrusters' under the first convention noted above or 'progressive' under the second classification. A major conclusion of this work is, therefore, that for firms with a successful product but restricted resources, outward TL can be a highly effective strategy. In such firms, the 'trigger' signal appeared to have frequently been the success of the product in home markets leading to approaches by potential licensees for the rights to sell that product in other markets. To an extent it can therefore be concluded that such use of TL is also generally a reactive rather than a proactive process, since the initial stimulus for its use arose from outside the firm. The number of case firms citing TL as their major means of market realisation was low however.

Inward licensing firms appeared to conform much more closely to the definition of 'sleepers' under the PEP convention mentioned above or as either parochial or adaptive under the Carter and Williams definition. It was a striking conclusion of the case studies that where inward licensing was being used it was frequently in response to a previous failure of the firm either to develop its own products 'in-house' or as the result of a crisis involving already existing products. Its use as part of a formally developed strategy to diversify into new areas seemed generally absent. However, although the use of TL did not usually appear to have been previously integrated proactively into a strategic framework prior to its use, but appeared to be generally adopted on an ad hoc basis, its success as a strategy once adopted, both in incremental and diversified development, seemed high. This supports the conclusion that smaller firms can act in a highly flexible manner, using TL where a trigger signal stimulates such use. Thus the first hypothesis in Chapter 6, that TL is generally used proactively by smaller firms appears disproved, but the parallel examination of its use in an ad hoc way demonstrates it success as a strategy where it is adopted.

Previous work, notably the 'Leverhulme' study described above and the analysis in Chapter 6 showing that only 8% of the membership of the Licensing Executives Society is drawn from small firms. This suggests that only a small minority of small manufacturing firms carry out TL activities. This would suggest substantial information, organisational and managerial barriers to the successful use of TL by smaller firms. The case studies strongly suggested that such barriers are an important factor in the low incidence of TL usage in such firms. The conclusion under the first sub-heading is therefore that TL is under used by small firms. Its success as a strategy once adopted however does not appear to be in doubt, if the case study evidence is considered. In view of this conclusion, suggestions for its practical use by smaller firms are made in the relevant section below.

2. When Technology Licensing is used by Small Firms

Having considered the use of TL as one alternative method in the strategic development of the smaller firm it is now also pertinent to consider when TL is used in relation both to the competitive situation of the firm within its markets and in terms of the type of products that are licensed in and out. As suggested above, TL is only one of the options that are available to the firm. The competitive situation of the firm was considered in Chapter 6 and the internal and external factors making up that situation were explored from the point of view of trigger signals leading to the use of TL.

The competitive situation of most case companies was stated to be either medium or high in a large majority of instances. This suggests that high competition levels do make smaller firms consider the use of new forms of market realisation, as does the evidence in Chapter 3 that increased competition levels lead to pressures to diversify by small firms. Such pressures were considered to be reinforced in the case of those small firms with a small number of product lines. Since a significant minority of case companies stated that 'survival' was their current primary policy objective, it is reasonable to conclude that competitive pressures had stimulated the use of TL. A further conclusion must therefore be that TL is frequently a 'crisis' strategy, particularly in the case of inward licensing.

Acquisition of existing products in this manner may allow the firm time to develop into new areas of expertise. It is pertinent to consider therefore at what stage of the product life cycle firms had licensed products 'in' or 'out'. For those firms integrating the use of TL as a strategy it might be anticipated that products at different stages of the product life cycle would be licensed to fulfil differing objectives. However, this did not usually appear to be the case.

Consideration of a more formal approach to the use of inward TL rather than as an ad hoc strategy suggested that few case companies had considered TL in terms of developing their product portfolio from the product life cycle viewpoint. A large majority of the inward licensed products conformed to the 'star' or 'cash cow' classifications of the Boston Consulting Group (1) analysis however, also lying within the current product competence of the firm rather than comprising new products in which the company currently had no skills. Diversification seemed largely absent. This result might be anticipated if firms were using TL in an ad hoc manner to fill product line deficiences rather than as part of a

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1. Boston Consulting Group (BCG) op.cit.

planned strategy and supports the conclusion that most such companies were seeking already successful products that would fit with their existing portfolios and skills, whether this was as part of a longer term strategy or in response to a product crisis. However, it was also clear that a minority of smaller companies had also used TL to overcome significant growth or competitive barriers to reduce risk levels in entering new markets. The implications of this conclusion in terms of a more formal consideration of the use of BCG analysis as one model for identifying cash utilisation and flows within the small firm are discussed at more length below. The low incidence of technology being licensed 'in' at the research stage or prior to its success as a product in other markets also supports the conclusion that inward TL is not normally used by smaller firms as part of an underlying strategic process but is more usually adopted in an *ad hoc* manner.

The situation for outward licensing small firms gave more support to the value of the product life cycle as a means of identifying products suitable for exploitation by TL. Many case firms had considered and used other forms of market realisation at several stages in the development of a particular product. TL had usually been chosen either to reinforce these other methods in difficult markets, but more frequently as the most appropriate mechanism for profit maximisation on a particular product line when the success of that product line had already been shown. Resource limitations in the exploitation of successful products had frequently led to the use of TL, while tariff barriers in particular markets had also led to its use in some instances. Once again therefore, TL appeared to be used in a significantly reactionary way. With a degree of caution it can be concluded that the use of TL usually arises in a relatively opportunistic manner in the case of outward licensing. However, it was also a clear result of the research that having adopted the use of outward TL, most firms used it highly proactively both for the initial product and for other product lines.

A major conclusion under the second sub-heading is therefore that competitive pressure is a useful means for considering the use of TL by smaller firms. The case study evidence strongly suggests that such pressure, leading to a fast requirement for new products, fosters the use of inward TL as a form of crisis management in many smaller firms, also suggesting support for categorising many such firms as 'sleepers' as noted above. Outward TL appeared to be used mainly opportunistically by sample firms but was then frequently integrated into the strategy of the firm in a more formal manner. Once again, this would conform to the 'thruster' categorisation noted above, as companies identified a potentially attractive form of market realisation and exploited it to the full. These conclusions pertaining to the use of TL in smaller firms can be contrasted to those reached in Chapter 5 regarding the use of TL in larger firms. It was suggested there that TL had been used <u>explicitly</u> as a competitive weapon in market sharing agreements with other firms, particularly in such instances as the pharmaceutical industry.

A final conclusion under this heading is that the use of TL is subject to substantial learning processes. Companies that had used it once appeared to use it again in many instances, suggesting that such learning barriers could be overcome. Learning and other barriers could explain the low incidence of TL in the small firm population generally but would also suggest that once adopted, TL can act as a flexibility enhancing mechanism for the small firm.

3. How Technology Licensing is used.

It was previously postulated that TL could be an important alternative strategy to 'in-house' development or other forms of market realisation. Acquisition or sale of products by smaller firms could mirror the sale or acquisition of companies by larger concerns. This would suggest a portfolio approach to the use of TL in the development of new product and market strategies, conforming to consideration of the relationship between different products within that portfolio and the barriers preventing better exploitation of those products. Three questions arise therefore: First, do firms consider their product portfolios effectively as investments and do they therefore seek to reduce risk by diversifying into new products and new markets using TL. Secondly is a 'cash flow' relationship between products within the portfolio recognised,as the Boston Consulting Group matrix would suggest, and do firms consider the implications for their portfolio in developing the use of TL. Lastly, in view of the 'threshold' barriers proposed in Chapter 4, is TL used to overcome such barriers.

A major conclusion of Chapter 3 was that small firms did carry out substantial diversification into new products and markets. However, the evidence presented in Chapter 6 suggests that in the case of product line diversification, TL was rarely used. This is, possibly, a surprising conclusion in view of the postulated advantages of TL in overcoming resource and other constraints explored above.

However, the use of inward TL did usually appear to be more of an incremental process through development into new areas, but utilising already existing skills and in assisting the development of current activities. Its use as a crisis response mechanism was also highlighted. It is therefore a central conclusion of the thesis that inward TL is not normally used in diversification strategies in entering new product areas. It is postulated that the problems involved in incorporating new technology, production and marketing methods at the same time may lead to too great problems for smaller firms to overcome.

In the development of new markets however, outward TL appeared to be valuable as a means of diversifying into new areas. Many case companies had entered foreign markets in which they were previously not represented through the use of TL. Clearly it can be concluded that TL in this instance was only one variable factor, allowing the firm to develop its use successfully.

The use of the BCG model to analyse companies product and market development strategies was suggested to be a potentially valuable tool in understanding why particular products were licensed 'in' or 'out'. BCG analysis would suggest a highly proactive measure of the profitability of particular products leading to a decision to develop them in a different way or divest them. None of the case companies identified BCG explicitly as a means by which such decisions were made, although it was clear in several cases that such decisions were being made implicitly upon an analysis comparable to that proposed by BCG. Outward licensing to obtain a return on products that would otherwise have been of little value was used by several case companies. Only one of the sample companies identified the use of royalty flows for the development of new ranges of its products as important, however. TL did appear to be used proactively by many case companies to overcome threshold or other barriers, to develop into geographical markets they could not otherwise have entered, as the discussion in Chapter 6 suggested. This was more generally true of companies using outward TL to overcome resource constraints than for inward licensing companies overcoming technological barriers. However, as a risk reduction process, it did also seem valuable in inward TL as a major supplement to 'normal' R & D expenditures in new product development. This would suggest that such use of TL might allow smaller firms to act as if they were bigger in competing with large firms with more extensive resources.

The conclusions to the question of how small firms utilise TL must therefore lie in a consideration of its practical use in relation to its anticipated use. TL did appear to be useful in overcoming threshold barriers, as the conclusion to the second hypothesis in the previous chapter suggests. Its general adoption as a more formal strategy in business development in most smaller firms is clearly more open to doubt however. In this regard, the small sub-set of case firms which had utilised both inward and outward TL seemed particularly relevant, if atypical, of the case firms as a whole. These firms did appear to have formally integrated the use of TL into their business strategies.

4. The Success of Technology Licensing as a Business Strategy

If survival, followed by profit maximisation are considered to be two major objectives of the smaller firm[1], consideration of the use of TL in achieving those objectives might be valid. In the case of inward licensing, several firms had clearly used TL to overcome substantial difficulties, and in at least two cases it was suggested that they had survived as a result. As a survival strategy therefore the use of inward TL did seem valuable. However, a majority of inward licensing companies had used TL more as a resource conservation process than for survival per se. The use of TL in such instances had allowed the release of resources for more profitable use elsewhere. TL had, therefore been used as a 'stepping stone' towards new product development 'in house' conforming to the incremental development of new markets noted above. While this process could be considered as allowing for a greater number of activities to be carried out it could not be formally described as profit maximisation per se. It is a main conclusion therefore that inward TL can be a highly successful strategy, as the very small number of case failures show. Its success in assisting both survival and development seemed clear. As part of a policy of profit maximisation was concerned however, its value in reducing development costs was evident but its use in practice as an identifiable objective in this role seemed less clear.

Conversely, the value of outward TL as a survival strategy seems less important while its use as a means of profit maximisation seemed more evident and it was in this way that a majority of case firms appeared to use it, in exploitation of an already successful product. This strategy had led to high returns on a transaction cost basis as shown in Chapter 6. As an alternative to other forms of market

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1. Subject to the objectives of smaller firms proprietors explored in Chapter 1.

exploitation, outward TL seemed to be attractive to case companies either for resource related reasons or behavioural ones. Most outward licensing companies were exploiting a larger number of markets than would have been possible utilising direct export or other means of market entry. The value of the intellectual property to the company was therefore maximised, although the costs, in terms of personnel required, were also a substantial burden in some instances. Several case companies had utilised TL as a means of retaining a small size, without the necessity for growth that an increase in overseas marketing and sales would have required. It is possible to conculde therefore, that outward TL is generally a highly successful strategy for firms to follow, where they have an already existing successful product. For firms with less highly successful products, outward licensing appeared to be less attractive. A conclusion of this process is, therefore, that outward TL is mainly of benefit in reinforcing success, hence its use by mainly 'thruster' firms under the PEP classification also noted above.

In conclusion therefore, TL does appear to be a successful strategy for firms to follow in particular circumstances. Classifying the use of TL within a 'Business Policy' framework may be problematical however in view of the varied rationales involved in its use. However, as one of a number of methods of overcoming product and market constraints, its use in the technology policy of most smaller firms appears to be under utilised. The following section therefore endeavours to suggest how the use of TL in SFs could be stimulated in practice.

E. THE PRACTICAL USE OF TECHNOLOGY LICENSING IN NEW PRODUCT AND MARKET STRATEGIES

It has been a major conclusion of the research that companies did not usually use TL initially until an external trigger stimulated its use. Once used, however, it appeared to be generally a successful strategy to follow. This suggests substantial information barriers to the more widespread use of TL both in exposure to potential licensing opportunities and in knowledge and application of TL techniques within the firm. However, it was also a major conclusion of the study that the rationales for the use of inward and outward TL were often very different. As far as practical recommendations are concerned therefore, these are treated separately below. If TL is generally successful in practice it is reasonable to propose that its use should be considered by a larger number of firms than do generally use it. Development of specific mechanisms to promote its use at a company, industry or society level may be more problematical however.

1. Inward Technology Licensing

A major conclusion of the study was that TL appeared to be used highly reactively, often as a damage limitationstrategy to overcome a crisis. Its success in this role appeared to be high however, suggesting that earlier consideration in a more planned new product development programme could be valuable in stimulating the adoption of new products prior to a crisis arising.

A first proposal is therefore that the consideration of TL should form an integrated part of the new product development process in smaller firms. Such an approach would suggest a complementary use of TL to the development of new products 'in-house', the use of sub-contracted research and development facilities, or the acquisition of other companies as a means of obtaining new product lines.

However, an ability to identify suitable sources of information on the availability of TL opportunities and methods by which TL could be utilised within the firm could prove to be barriers to its more widespread use. An important sub-set of inward licensing small firms appeared to have carried out extensive and detailed searches for new licensed products, leading to success, while other firms had obtained their products as the result of chance meetings or other ad hoc factors. Those firms which had used inward TL on a continuing basis had clearly developed longer standing means of licence search than had the others. A major recommendation flowing from the research is therefore that for manufacturing companies with long term product development strategies, search for potential new technology to license should be a continuing process, with sources of information on potential opportunities being continually assessed. Such a strategy might be anticipated to be more successful than a 'one-off' approach.(1)

Several public and quasi public agencies appear to have reached similar conclusions with regard to the provision of information on

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1. See Lowe J and Crawford N K op.cit. Proposals for integrating the use of TL in new product development techniques

TL opportunities.[1] If information availability is an important barrier to the use of inward TL it might be anticipated that such agencies would be successful in promoting the use of TL in smaller firms as part of a more proactive strategy of product development. The value of enhanced information availability could be measured empirically and some suggestions for practical examination of the success of public initiatives in this area are suggested under 'Further Work' below.

As a strategy for diversifying into new areas, inward TL did not appear to have been widely used, as shown above. The problems in introducing a product from a different culture seemed high if that product required skills that were not already available 'in-house'. As a strategy for small companies to use in entering very diverse new product areas, therefore, TL does not seem to be a generally successful strategy and its use cannot be recommended for this. However, in introducing a new product to build upon existing skills, its use appeared highly successful. For small firms seeking to fill product line gaps therefore, the use of inward TL seemed a highly useful technique to consider.

In conclusion therefore, for smaller firms requiring new technology the use of TL seemed advantageous, subject to the objections noted above. If the sample firms used in this study are typical, its use might be anticipated to increase in the future in light of an

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1. For example, the Scottish and Welsh Development Agencies, the London Enterprise Agency, Tyne and Wear and West Midlands Councils have all recently set up agencies to promote provision of such information in an attempt to stimulate local economies.

increasingly competitive environment for the smaller manufacturing firm and increasingly sophisticated means of publicising the availability of TL opportunities.

2. Outward Technology Licensing

Most of the case sample companies had developed the use of outward TL as a means for enhancing returns on products that had already been successful in their home markets. The trigger to the use of TL in these cases had frequently been approaches from potential licensees wishing to market the product in their own markets. In other cases, outward TL had been used more proactively, in overcoming tariff or other barriers to the exploitation of overseas markets by direct export. Most of the products concerned appeared to have been 'star' or 'cash cow' products under the BCG convention, which the firm wished to make the maximum benefit of quickly, with the limited resources at its disposal.

In consideration of the lessons that smaller firms might draw from this work therefore, it is pertinent to consider whether such firms generally are able to utilise other forms of market realisation in exploiting foreign markets. Clearly, case companies had generally used TL because of the lack of such resources. For companies with highly successful products in home markets therefore, it seems clear that a strategy of TL can be advantageous in developing the returns accruing to that product and hence enhancing the return on the investment involved. For less successful firms with fewer 'market leader' products however, a strategy of outward licensing to advanced country export markets seems more open to doubt as a successful strategy. TL of less advanced technology to developing countries seemed more successful here, although the management and administrative costs of doing so also seemed higher.

In conclusion therefore, outward TL for non 'brand leader' products does not usually appear to be a suitable strategy for small companies to follow. The costs and problems of finding licensees where these do not approach the licensor initially may be prohibitive. However, for smaller companies with brand leader products, outward TL does appear to be a strategy allowing profit maximisation on particular product lines.

F. POSSIBLE FURTHER WORK

The studies carried out for this work have been constructed within a framework of the strategy developed by smaller firms using TL. However, the case study approach adopted has highlighted at least two areas in which it is suggested that further work could usefully be carried out to elucidate other aspects of TL and build upon the research reported here. First, a direct comparative study of the use of TL compared with other forms of market development could be valuable in elucidating more of the behavioural factors and the barriers involved in the use of TL. Second, if, as postulated above, there is a relationship between the amount of information available on TL opportunities and its use by smaller firms, measures to clarify this relationship could also be useful. Thirdly, in view of the frequently complex relationships between licensor and licensee that the case studies suggested, further research into these relationships to elucidate behavioural and economic implications over time would clearly be valuable. Lastly, in view of the suggestion above that TL was being used as an alternative to acquisition in development, further exploration of this factor would be valid.

A comparative study of the use of TL and other strategies could involve the use of twinned companies, where one company used TL and the other another form of product or market development. In the case of inward licensing 'twins' could be drawn up for companies using TL and 'in-house' product development, sub-contract development or company acquisition as a means of developing product portfolios. It is suggested that such a study could be valuable in evaluating more accurately both the success and possibly more importantly the financial implications of adopting a strategy of licensing 'in' over a longer period of time in comparison with other strategies.

The use of outward TL by companies could be examined by comparing 'twins' using TL and direct export, the use of local agents or local company acquisition as a method of market entry and development. Such a twinned study could demonstrate whether the use of the Boston Consulting Group matrix as a means of drawing up and formulating a marketing strategy was valid in terms of developing 'cash cows' as resource providers for other product developments. Once again the financial implications of following the different strategies could be measured.

However, in light of the small number of companies utilising TL it must be recognised that identifying such twins could be problematical. Firms in similar industries, with similar products and resources would be required and such studies would have to be carried out over an extended period.

The role of 'information' in the scope and scale of TL was mentioned above. It was concluded that information availability, particularly in the area of potential products available for licensing 'in' was crucial. Various public agencies have recently set up services dedicated to the provision of information on technology that might be available for transfer. Provision of such information, particularly in view of the localised nature of its availability[1] provides an opportunity to measure whether enhanced information will increase the quantity of TL among small firms. If such an increase could be demonstrated this could be an important finding in the formulation of technology policy at both a local and national level.

The relationships between licensor and licensee developed during the course of a licensing agreement have been explored only briefly in the course of this research into the use of TL as a business strategy. It is clear however, that many licensing relationships are of a long standing nature and provide benefit to both parties over extended periods. Research to elucidate the relationships developing within what could be termed a 'symbiotic' development between large and small firms and small firms per se would clearly be valuable in understanding how two frequently very different company cultures cooperate over time to the benefit of both parties. It is suggested that such research could be carried out within an organisational behaviour structure with the objective of both understanding how cultural barriers might preclude successful longer term cooperation and in understanding those factors leading to its successful use.

Fourthly, company acquisition has been suggested as an alternative to the use of technology licensing. It is clear that many larger companies do use acquisition as a means of market entry in diversification and

1. Since most of the agencies referred to have been set up by local authorities or development agencies, only companies within particular geographical areas can obtain access to the information made available providing the potential for a 'matched' study with other companies outside the agency areas.

development. Such acquisition does effectively cause a transfer of technology into the acquiring organisation, although the process and result is clearly somewhat different than such transfer under a licensing agreement. It is suggested that a comparative study of the use of TL and acquisition as alternative methods of development and market entry could be valuable in elucidating the mechanisms whereby companies maintain development momentum in managing growth. Such a study could also highlight any relationship between size and proclivity to utilise TL or acquisition, an investigation which has not been attempted here, but could build upon the empirical work reported above.

It is concluded therefore that there are several major opportunities for further work in this field, which appears to be becoming of increasing importance, as governments seek to stimulate the extent and pace of technological change in, and development of, small firms. Although it is hoped that the work reported here will clarify some of the strategic implications of the use of TL amongst smaller firms, it is also clear that substantial further work is required before all aspects of the use of technology licensing by small firms is fully understood.

G. FINAL THOUGHTS

The original 'trigger signal' for this study was a practical situation within one company seeking to diversify into a new market with an untried product in which it had very little production technology. Although substantial marketing strengths were available the project was abandoned before market entry, even though the technical problems of the product had been solved. In light of this study the question can be asked 'would technology licensing have been a more appropriate method for market penetration'. To this, the answer may have been a qualified 'yes'. Although substantial diversification was involved, the success of the company was based upon its marketing strengths, and in this area little diversification would have been involved. The researcher feels reasonably sure, therefore, that success in this case could have been achieved.

Finally, the research was commenced on the basis that TL could, in principle, be used as a universal technique for small firms development. This is clearly not the case. Probably a majority of smaller manufacturing companies have neither the managerial resources nor the inclination to utilise techniques which fall outside their previous experience, and what might be termed 'normal' or 'in-house' techniques for product and market development, unless forced to do so.

Therefore in answer to the question 'Is Technology Licensing a Valid Business Technique', the only conclusion that can be reached is 'In Certain Circumstances'. Its value both as a crisis management strategy and in profit maximisation has been shown above. Clearly TL can be used as a 'one off' process in both these cases. However, in light of early conclusions on the relatively ad hoc nature by which many small firms develop new products or enter new markets and the equally ad hoc nature of TL adoption in such firms, it is probably pertinent to conclude that a fundamental advantage of its use lies in opening the firm to a larger number of new business opportunities than would otherwise be the case.

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